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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****BRACKETS / BUCCAL TUBES**

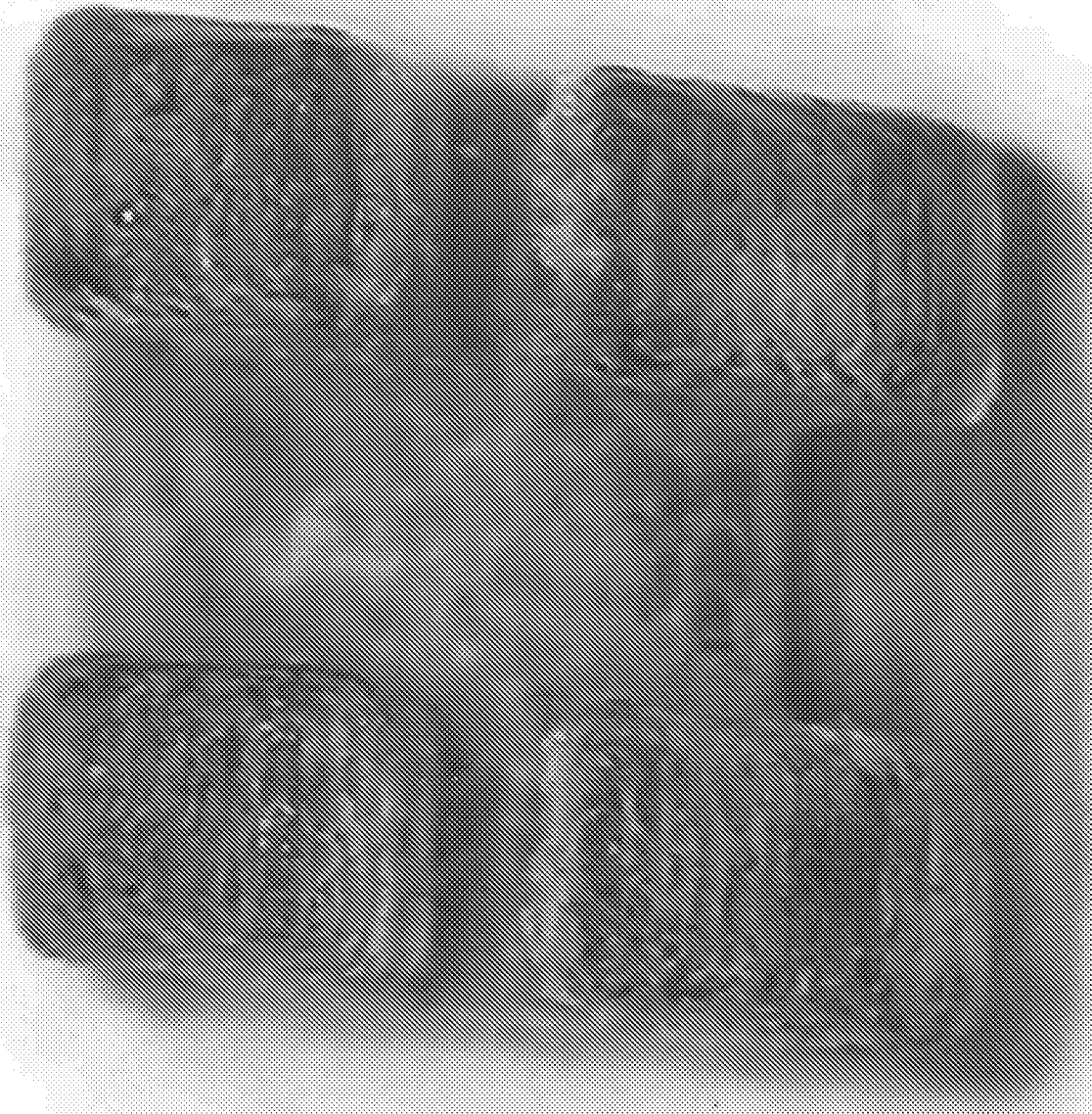
*CustomR<sub>x</sub>* CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)

- a. Lab Reopening (Craig Andreiko)
  - 1) Accomplishments / Status
    - ☒ Scanned image of the PK Thomas Case lower Jaw
    - ☒ Created new software modules to calculate the set-up of the lower jaw: the mandibular skeletal bone can be defined by the operator along with the mesio-distal width of the lowers 7x7, using photographic recomposition of the scanned model.
    - ☒ Successfully printed upper bracket tree (3 samples) and had them setup for casting.
  - 2) Goals For October
    - ☐ Implement new modules in the set-up programs to create the mandibular set-up and adapt the occlusion with the maxillary set-up.
    - ☐ Test the casting process of the bracket trees.
    - ☐ Manufacture the new jigs with the new attachment.
    - ☐ Assemble the upper case, using casted brackets and new jigs.
  - 3) Major Project Milestone
    - ⊙ Lower/Uppers Setup for the PK Thomas case: November 97
- b. 3D Digitizing (Eric Chapoulaud)
  - 1) Accomplishments / Status
    - ☒ No Action this month.
  - 2) Goals For October
    - ☐ A malpositioned case will be scanned to be used as test data with the new set-up software being developed.
  - 3) Major Project Milestone
    - ⊙ First Clinical case scan: November 97.
- c. Bracket Fabrication (Eric Chapoulaud)
  - 1) Accomplishments / Status
    - ☒ Software upgrade of the ModelMaker II Driver was installed, along with modifications in the parameters file. It improved jet reliability and parts quality.
  - 2) Goals For October
    - ☐ Print parts to check for accuracy and reliability.

**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION**

- 3) Major Project Milestone
  - © Reliable printing operation: October 97.

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# TRAVEL REQUEST

**DATE:** July 11th, 1996  
**TRAVELER:** Eric CHAPOULAUD - R&D  
**TRAVEL DATES:** July 25, 96 to July 28, 96  
**TOTAL FARE:** \$ 533.00

DATE	AIRLINE CARRIER	DEPARTURE CITY	ARRIVAL CITY	TIME OF DEPARTURE	TIME OF ARRIVAL
July 25th, 96	Amer.Airlines	L.A. (LAX)		8:00 AM	
		Boston			4:34 PM

July 28th, 96	Amer.Arilies	Boston		8:30 AM	
			L.A. (LAX)		11:26 AM

## APPROVAL

**DEPARTMENT HEAD:** \_\_\_\_\_  
**BUSINESS UNIT VICE PRESIDENT:** \_\_\_\_\_

## DECLINED/COMMENTS

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# TRAVEL REQUEST

## MULTIPLE DESTINATIONS

**Date:** 7/29/96

**Traveler:** E. CHAPOULAUD

**Travel Dates:** Aug 12-15, 96

**Prepared By:** E.

**Travel Agent:** Robin ROBERTS

**Total Fare:** \$ 842.95

DATE	AIRLINE CARRIER	DEPARTURE CITY	ARRIVAL CITY	TIME OF DEPARTURE	TIME OF ARRIVAL
8/12/96	AA - 146	LAX	BOSTON	8:00 AM	4:34 PM
8/15/96	AA - 147	BOSTON	LAX	5:30 PM	8:35 PM

### APPROVAL

**DEPARTMENT HEAD:** \_\_\_\_\_

**BUSINESS UNIT VICE PRESIDENT:** \_\_\_\_\_

### DECLINED/COMMENTS

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
31																								
32																								
33	ERIC CHAPOULAUD																							
34																								
35	Depart. Name	R&D																						
36	Business Purpose	SANDERS Prototype Evaluation																						
37																								
38																								
39	TOTAL MILES	0	COST/MILE	\$0.24	\$0.00	\$0.00																		
40																								
41	TOTAL EXPENSES	\$33.35	\$0.00	\$0.00	\$48.00	\$63.18	\$207.36	\$0.00	\$0.00	\$0.00	\$194.01	\$45.90												
42																								
43																								
44	MAKE CHECK PAYABLE TO:	ERIC CHAPOULAUD																						
45																								
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47																								
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50																								
51																								
52																								
53																								
54	AUDITED																							

TRAVEL EXPENSE STATEMENT

10/31/1996 THROUGH 11/3/1996

STATEMENT PERIOD

U.S. Dollars

The company will not issue expense statements for personal tax purposes. An extra copy should be retained for

PERSONAL MILEAGE ALLOWANCE	\$0.00	\$0.00	301-301-8010	71800-840	1000000	0.00	entertainment
TRANSPORTATION PREPAID BY COMPANY- CO. BUSINESS	\$0.00	\$0.00	301-301-8010	71810-840	1000000	0.00	phone/fax
			301-301-8010	71820-840	1000000	242.01	travel
			301-301-8010	71830-840	1000000	207.36	lodgings
			301-301-8010	71840-840	1000000	63.18	meals (self)
			301-301-8010	71825-840	1000000	33.35	auto expense
			301-301-8010	71780-840	1000000	0.00	postage
			301-301-10000-13410	840	1000000	0.00	temp. advance
			000-1000-100000-100000	840	1000000	0.00	(71108-) supplies/office
			000-1000-100000-100000	840	1000000	0.00	
			TOTAL EXPENSES			545.90	

Mileage begin

0

Mileage end

0

Mileage business

Craig: Please READ

*Sub Finish*

<b>Date:</b> November 6, 1996
<b>From:</b> Eric CHAPOULAUD
<b>To:</b> Albert RUIZ-VELA, Craig ANDREIKO, Dan EVEN
<b>(c):</b>

<b>SANDERS Prototype: Wax printing Device Evaluation Visit</b>
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Since a few months, Craig ANDREIKO and myself have been evaluating 3D Solid freeform manufacturing devices that could be connected to our ELAN application and able to manufacture directly customized brackets. The technology currently available offers different type of materials among them photo-polymerisable (Stereo-lithography) and wax (3D plotting), and more important for our application, low resolution and accuracy except for the Model-maker 3D plotting device manufactured by SANDERS prototypes Inc.

Currently, the SANDERS **Model Maker** machine is the only one that can reach our accuracy needs: < 0.001 inch by offering the possibility of a 0.0005 inch resolution. We have conducted some tests with the west coast distributor by having him manufacturing parts that were created with our CAD software, and further with our new ELAN application software. The results have been promising in respect to the general aspect of the wax parts "plotted" and the dimensions as well. We have good hopes that this machine would allow us to manufacture customized brackets.

Nonetheless, we think that our application is sufficiently outside of the usual utilization of such machine that we have been advised by the local distributor that we should meet with the manufacturer in New Hampshire in order to point out the specifics of our application and discuss with him modifications and optimization possibilities in regard to our process. This meeting took place in WILTON N.H. on November 1st 1996, involving E. CHAPOULAUD for ORMCO and Mr MACINTYRE (National Sales V.P.), WIGAND (Technical Development), <<Chris>> (Customer Support) and Mrs COLLINS (Training) for SANDERS Prototype. The Object of the meeting was to discuss our specific needs and the machine characteristics with Application and development engineers, discuss some interface problems and solutions, as well as communication between our software application and the software that drives the machine with software development engineers and discuss the training aspects for our in house operator.

#### 1) SANDERS Prototype Inc.:

This company has been created two years ago on the basis of patents on a wax printing technology, to develop and commercialize a "3D Plotting System" that is named "**Model Maker**<sup>TM</sup>". It currently employs 50 people and has shipped over 80 **Model Maker** machines (each machine is listed at \$60 000), which is its only commercialized product.

They are located in WILTON N.H. (small town in the outskirts of NASHUA N.H. about 60 miles north of BOSTON). Its President is Mr Anthony FINIZZIO. The medical supply company BAXTER recently acquired a 20 % stake of SANDERS (Contact at BAXTER is: Paul DIPERNA (847) 270 5502).

#### 2) Model Maker: Desktop 3D Modeling System

Their product presents itself as a desktop unit that supports the CAD designer's workstation environment, allowing designers the ability of creating a physical 3D Model from their CAD design. This machine uses the same technology used in "inkjet printers" adapted to deposit thermo-wax droplets in successive layers allowing the build of 3D Objects from ground up. As we said above, our interest in this technology relies on their ability to use small layers (0.0005 in or 5 tenth of thousands of an inch, 12.5 micrometers) to create the 3D model. This machine is the only machine currently marketed that allows such small layers.

On a software point of view, this machine is usually connected to a PC Computer running a specific application program developed by SANDERS. This program uses ".STL" files as inputs. These type of files

can be created by most of the CAD programs, including SolidWorks, from their own geometry format. The Sanders program can also accept other formats which will be discussed further. The ".STL" file is first "sliced" into a number of layers representing each layer's perimeter of material. Then these layers are used to create the jet-heads travel paths that will construct the 3D model. This machine operates as a inkjet printer that fills the contours representing the layers. Using well known software technology, it moves the jet heads in straight lines between each end of the contours, filling up the inside of the perimeter of layers.

In order to produce accurate layer depths, the machine deposit more wax than necessary, waits for the wax to cool and uses a cutter to cut off the excess material. On the positive side, this process allows the machine to be able to produce layer thicknesses down to 5 tenth, but it also gives a slow process since cooling waiting time becomes a big factor in the model manufacturing time.

Since each layer of Wax need to be deposited on "something" to construct the model, **Model Maker** deposit a layer of another material to be used as support for counter-parts in the model. This material is also Wax, but has a lower melting point temperature, that allows this support material to be removed after the model is built. A cleaning phase is then necessary in order to have the finished Wax part. Please refer to the documents in annex for more information.

This machine has been marketed for almost a year, and customers reaction and comments have lead Sanders into upgrading the **Model Maker** to a new version that will be available in 8 months from now according to their National sales V.P. This machine, called "**Model Maker II**", shows improvement in mainly three aspects: Speed improvement in the Jet Heads Motion and head's wax delivery rate, Reliability and Speed improvement by air conditionning the printing space, Usability improvement by improving the building space to 12 x 6 x 9 inches against 6 x 6 x 6 inches for the current machine. According to Sanders, they are working on improving their material as well. In fact the new machine includes Higher temperature Wax-jets, allowing the possibility of stronger build material along with a better separation with the support material. This machine will be presented at AutoFact 96 in Chicago (November 11 to 16) as a beta version.

The current version of the machine is priced at \$ 59 900, while the new machine will priced at \$ 64 900. Sanders proposes the possibility of ordering the new machine as of now. Sanders will deliver the current version at the current price and when the new version is ready (June 97), it will be installed for an additionnal \$ 10 000.

### 3) Characteristics and Specifications

>> See with Rob Connelly (Users Group)

### 4) Training and Operation

With the purchase of the machine, a training session is offered for 2 or 3 people for a duration of 2 days. It includes training on the software and hands on the machine parameters. Sanders suggested that this training can be extended for another day allowing future users to work on their own parts, getting usefull suggestions and advises directly on their type of models.

The software is relatively easy to use, specially to an operator familiar with 2D/3D CAD design programs. The software works on any platform (Windows 3.1, Windows 95 or Windows NT). The new version that I was demonstrated is simpler than before and provides the operator with fewer options, for a less confusing environment. The current control software works with DOS, but does not involve any experience on DOS.

Everybody at Sanders stressed upon that experience is the key of success in using their machine. Our operator would have to run lots of different parts and orientation in order to be very familiar to the machine behavior and produce good parts with sufficient repeatability and reliability. This machine needs to be taken good care of since it involves a lot of moving parts and "messy" wax drops.

Last month, a first meeting of a new **User's group** was held. This group is set aside Sanders influence while Sanders welcomes the initiative. This group is organized to share information and experience about **Model Maker**. This is most certainly a mine of information our operator could use.

### 5) Application development Toolkit

Sanders **Model Maker** machine is usually used as a peripheral of a CAD workstation, allowing designers to "print" a 3D model of the part they design. On the other hand, we think that we can use this machine to manufacture small quantities of brackets (ie: new products for clinical tests) and further, use the **Model Maker** machine to manufacture customized brackets along with the Elan program. Using the 3D Modeler, we can design a software that creates completely the brackets, according to the particular dimensions of each tooth, and send these design to the Wax printer to create a master to use to cast the finished part. This is a new and specific application for Sanders.

After discussion with John WIGAND (Technical Development), Sanders was interested in extracting a library of functions from their current program. This library would allow us to use their machine as a new device in our program, keeping our User interface. Our software would be able to launch the printing of the parts and get a status of execution. We also decided that ".STL" files was not a good interface between our softwares. We were supported by Al HASTBACKA in that direction. We would send "slice files" to the library, since our software already has all the informations to extract the slices. We agreed with Sanders that we should put interface specifications on a joint document, so as to avoid confusion during the development. We proposed Sanders assistance in that specific development by spending some time with them while testing the interfaces. A "white paper" presenting different options should be composed by Sanders and sent to us.

#### 6) Tests: One piece Brackets

While going over the new software version at Sanders, we have been able to manufacture a sample of two different one piece brackets that were designed by us. These parts are the most complex parts that we have asked Sanders to make. Most particularly, their pads includes a collection of little "pegs" of 0.015 x 0.015 inches. These are very little details that are correctly reproduced by the machine.

*Surface finish can be improved by laying down less material.*

#### Conclusion:

The Sanders **Model Maker** is a very ingenious machine that performs correctly when the design is appropriate and should be able to maintain our tolerances ( $\pm 0.001$  inch). The Wax parts produced are fragile but are not intended to be used as such: they will be used as masters for casting. Operation wise, **Model Maker** is easy to handle and its software is in continuous progress. It is essential with this machine that our future operator is well trained and maintain the machine correctly. The current version of the machine seems to be very sensitive to its environment (heat, vibration ...) while the next version could be faster and more reliable if we believe Sanders claims.

Sanders is a small company but is easy to contact and its people are very customer oriented. A good support is to be expected from this company, since this machine and its technology is relatively new on the market.

As far as cost of operation, this machine has a very good benefit since the material used (wax) is cheap, and the machine can work unattended so the operator cost is low. The material is provided only through Sanders while it actually does not manufacture the wax.

Eric CHAPOULAUD

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

#### A. SUMMARY

This request is for the purchase of a Desktop 3D modeling system to be used along with our *Élan* customized appliance system. The ability to directly produce 3D wax master models from the computer design will allow *Élan* to create full customization including the Pad shape for example. This machine will also be connected to our 3D CAD modeling system SolidWorks, as a rapid prototyping peripheral. This will allow our design team to obtain a 3D physical model of new product design within a few hours, or create small batches of parts to use in clinical tests. The total investment will be \$ 76,900.

#### B. EXISTING SITUATION

Contemporary orthodontic prescriptions rely primarily on norms and principles developed by Dr. Andrews. Individual preferences of leading practitioners have created modifications that form the basis of the prescriptions which clutter the orthodontic marketplace today. Ormco's *Élan* program, has employed sophisticated computer hardware and software to re-examine the existing appliances and techniques, and design a more systematic, state of the art orthodontic appliance system (brackets, molar tubes, archwires and jigs).

In the existing *Élan* system, we use "Vanilla" brackets preforms that are positioned in a milling machine where the final characteristics of the customized bracket are cut into position (Torque and Rotation In Slot, if necessary). This involves two steps as manufacturing has to produce "Vanilla" brackets batches and a second phase of characterization will be performed in our laboratory. While this technique has been proved adequate for the current system, it cannot be improved to add further customization, in the Pad shape, dimension and adhesion surface for example. Moreover, with our current system it is very complex to implement customization for lingual appliances, since not only we need to adapt the torque but also the InOut. Most specifically, since our designs evolve into one piece brackets, the Pad design becomes completely related to the bracket design for labial as well as for lingual appliances.

These new design constraints have led us into switching our CAD software capabilities from 2D to true 3D modeling, in recently investing into 4 SolidWorks CAD workstation seats (CAR # D-0196). Although this new system provides us with nice viewing capabilities of our 3D model designs, it would be sometimes very useful to be able to produce a real model representing the design so as to

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

verify functionality and scale of our very small parts. Most often, we need to set up small batches of parts of our new design to send to our clinicians for clinical tests purpose. The current method involves setting up R&D temporary tooling and manufacturing process to produce such batches, and therefore has a tooling and labor cost.

#### C. PROPOSED SOLUTION

We believe that the *Élan* appliances, when properly used as an integrated system, will provide more effective and efficient orthodontic treatment, at lower cost and with measurably better outcomes in every aspect that is important to both orthodontist and patient. Along with our investigating clinicians, we also think that *Élan* system will gain better accuracy and quality if completely customized.

Our new *Élan* software provides us the ability to automatically create 3D CAD bracket designs from a set of parameters such as Torque, RIS and also size and shape (Diamond angle). It will be further improved to allow complete customization of the Pad for example. While investigating methods of manufacturing to be used with this feature, we have evaluated rapid prototyping equipments that produce 3D models directly from 3D designs. After different feasibility tests, we have singled out the Model Maker machine manufactured by Sanders Prototype Inc. (Wilton N.H.). This machine has the capabilities to produce Wax models with a tolerance of +/- 0.0005 inches that can be used as investment casting patterns. This machine provides software to process CAD files and produce the wax representation of the model. It is possible to link this machine's software to ours so that we can produce almost automatically fully customized bracket designs. In order to produce the final part, we would cast the wax patterns, using standard techniques that we know well.

The Model Maker machine can be connected to our 3D CAD workstations as a rapid prototyping peripheral. This device uses standard CAD formats and produces wax patterns within our tolerances and in a sufficiently short time. It can operate unattended, at night for example.

#### D. INVESTMENT REQUIRED and RETURN ON INVESTMENT

The Model Maker II cost is \$ 64,900 for the new version that will be available in June 1997. Sanders Prototype proposes a deal that includes delivery of the current version of the machine at the current price \$ 59,900 and a switch to the new version when available for an additional \$

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

15,000. Two days of training are included in the price. Support is free for the first year (Additional years of maintenance can be bought for \$ 6000).

We believe that this machine represents an opportunity for us to step forward in the direction of completely customized appliances that could not be possible in a cost effective way otherwise, for labial and lingual appliance as well. Model Maker from Sanders will also allow us to reduce our new product development costs by shortening our development process during the new product design phase. by having the in-house possibility of verifying functionality and tolerances on real models, costly design errors can be corrected at the design phase instead of after the pre-production phase. Such a machine reduces delays in bringing new products to the market, by reducing the number of iterations during the development and the pre-production phase. Finally, it gives us a definitely cheaper and faster way of producing small batches of new products that can be used for clinical tests.

#### E. RISKS and OPPORTUNITIES

During the evaluation of this machine, we have performed a number of tests that have been successful. We have created a 3D CAD design using our 3D Modeling workstation and have been able to create a wax pattern for investment casting within our tolerance specifications. We also have been testing successfully the possibility of producing customized brackets designed with our *Élan* software. Tolerances were also correctly observed. Although the Model Maker from Sanders is a new technology that will certainly improve in the future, we believe that this machine is presently able to produce parts that fit our needs.

#### F. RISK MANAGEMENT

A visit to Sanders facilities was able to show confidence in their ability to train and support new customers. Their software has been continuously improved for more user friendly functions and reliability. The new version of the machine available next year will improve speed, reliability and pattern material.

#### G. ALTERNATIVES

One possible alternative is to "do-nothing". This means that the *Élan* system will continue to produce parts through a two step process. From "Vanilla" brackets the design of which is costly and

## CAPITAL APPROPRIATION REQUEST SECTION II

### BUSINESS SUMMARY

**Project Title:** Elan 3-D Jigs (Project #853)  
**Prepared By:** Eric Chapoulaud / Martha Lomelli  
**Date Prepared:** November 6, 1996

difficult to change. It also means that we would not be able to rapidly test new products at the design phase or at the clinical test phase.

Our evaluation of the rapid prototyping offers at the moment showed that no other machine is able to produce our small parts within our tolerances. Our visit at Sanders demonstrated their commitment into solving our specific needs for the *Élan* system. They are able to set-up more strict specifications for us during their manufacturing process so that our machine would have even better tolerances. Finally Sanders offers the least expensive solution currently marketed for rapid prototyping.

#### H. INVESTMENT BREAKDOWN

An investment of \$ 76,900 will be required to acquire the Model Maker II machine from Sanders Prototype Inc. Pending shipment of the Model Maker II unit (Spring '97), a MM6-PRO (as quoted) will be installed for our use. When Model Maker II is available, Sanders Prototype will then replace the interim unit, install the new machine, and restart a 12 months warranty. Details of the capital investment are as follows:

#### CAPITAL:

1.	ModelMaker Unit	\$ 59,900
2.	Spare Printhead (Build and Support)	\$ 1,000
3.	MM6-PRO Interim program	\$ 15,000
	<b>TOTAL</b>	<b>\$ 76,900</b>

**Interoffice Memorandum**

---

From: Albert Ruiz-Vela

Date: January 3, 1997

To: Dan Even

Subject: **Monthly Report – December 1996  
Product Development  
& Engineering**cc: Mark Clineff  
Glenn Lyon  
Ernie Strauch  
Mark Vigna  
Eckhard VogelCraig Andreiko  
Kerry Darney  
Tony Elie  
Al Ezcurra  
Farrokh Farzin-Nia  
H.R. Ghalambor  
Mark Payne  
Tom Selkee  
Hamid Sheikh  
Raymond Thornton  
Ray Wong  
Harry Yawata  
Lourdes Lara  
Adriana Navas  
Larry Phaneuf  
Ron Simey  
Jim Warren  
Corinne Pantaleo  
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EXHIBIT G  
 ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION

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**TYPE II (Outside Vendor)**

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Error!

**TYPE I (Built In-House)**

Error!

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- BI-2. *Orthos-AD/AP* Alexander Discipline Asian Prescription Appliance System
- BI-3. *CustomR<sub>x</sub>* Custom Labial Appliance System
- BI-4. *CustomR<sub>x</sub>* Custom Lingual Appliance System
- BI-5. Adhesive Pre-Coated Brackets
- BI-6. Metal Slot Ceramic Brackets
- BI-7. Mandibular Anterior Repositioning Appliance (Dr. Eckhart)
- BI-8. Moisture-Resistant Adhesive
- BI-9. Wedge-Shaped Neck Strap (Dr. Alexander)
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- BI-12. *Orthos* AD in Spirit MB
- BI-13. Aluminum Bracket
- BI-14. Ni-Ti Ligaturless Bracket
- BI-15. Bite Turbo Bracket
- BI-16. Tooth Shaped Pad
- BI-17. Titanium Brackets
- BI-18. Titanium Buccal Tubes
- BI-19. Titanium Bands

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**TYPE II (Outside Vendor)**

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- ☒ Specified and built Reference sphere for view-melting protocol. Defined a Standard sphere with grooves for calibration check.
- ☒ Calibration of the Scanner using these elements. The scanner can be aligned and calibrated within 10 microns, insuring very accurate view-melting.

**2) Goals For January**

- ☐ Calibration Protocol: Implement the automatic view-melting method in the Calibration program (Background task).
- ☐ Calibrate the second sensor.
- ☐ Develop interfacing program allowing set-up of the scanning procedure using the global sensor and user defined views.

**3) Major Project Milestones**

- ⊙ Bite registration manufacturing: February 1996.

**DIII. BOND TOUGHNESS IMPACT TESTER (Project 959; Craig Andreiko / Eric Chapoulaud)****a. Accomplishments / Status**

- ☒ No test done this month.

**b. Goals For January**

- ☐ No Test to be done

**c. Major Project Milestones**

- ⊙ No major milestones.

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: February 7, 1997

To: Dan Even

Subject: **Monthly Report – January 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Don Frei  
  
Craig Andreiko  
Kerry Darney  
Al Ezcurra  
Farrokh Farzin-Nia  
Gary Garman  
Randy Hacker  
Jason Lee  
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- © Lab will reopen once 3D scanning and jig fabrication is completed.

**b. 3D Digitizing** (Eric Chapoulaud)**1) Accomplishments / Status**

Due to the power outage during the wind-storm at the beginning of the month, the scanner computer failed. A new single board pentium based computer is now at the core of the scanner. This new configuration introduced hardware modifications on the reset function of the computer, and power-up protection have been set-up to avoid the motion axis to crash at power-up.



The upgrade in processing power allows us to scan 3 times faster without changing the software. The scanner is now operational.

**2) Goals For February**

Upgrade the software libraries to provide faster scans.



Acquire new scans of upper and lower dentition.



Modify the Acquisition software to provide easier to use interface and more flexibility on the programming side.



Manufacture a bite registration using the newly acquired scans.

**3) Major Project Milestones**

- © Bite registration manufacturing: February 1996.

**BI-3. CustomRx CUSTOM LINGUAL APPLIANCE SYSTEM** (Project 953-E; Craig Andreiko)**a. Accomplishments / Status****b. Goals For February**

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☐

**c. Major Project Milestone**

- ⊙ Re-evaluate project once 3D scanning & jig fabrication is completed.

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: March 7, 1997

To: Dan Even

Subject: **Monthly Report – February 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Don Frei  
  
Craig Andreiko  
Kerry Darney  
Farrokh Farzin-Nia  
Gary Garman  
Randy Hacker  
Jason Lee  
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**ORTHODONTIC PRODUCTS****B. RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****TYPE I** (Built In-House)**BI-2. CustomRx CUSTOM LABIAL APPLIANCE SYSTEM** (Project 853-E Craig Andreiko/Eric Chapoulaud)**a. Lab Reopening** (Craig Andreiko)**1) Accomplishments / Status**

- ☒ Completed a first draft of a schedule leading to 5 clinical cases using 3D Jigs

**2) Goals For March**

- ☐ Review the plan draft.

**3) Major Project Milestones**

- ⊙ To be set according to the plan review

**b. 3D Digitizing** (Eric Chapoulaud)**1) Accomplishments / Status**

- ☒ 3D Scanning of the upper jaw of a P.K THOMAS model.  
☒ Developed functions in the model acquisition application to position brackets on the scanned teeth. Using the STL files from Spirit brackets, an appliance was set-up on the P.K. THOMAS model, and the corresponding wire was mathematically computed.

**2) Goals For March**

- ☐ According to the plan draft, we will create a Set-up application allowing us to manually position wires, brackets and tube and calculate the corresponding appliance on the P.K. THOMAS upper model.  
☐ Manufacture the Brackets and the wire  
☐ Start the bracket attachment and tooth registration part of the 3D Jig

**3) Major Project Milestones**

- ⊙ To be set according to the plan review: ( 3D Jig Design Review: May 1997).

**BI-3. CustomRx CUSTOM LINGUAL APPLIANCE SYSTEM** (Project 953-E; Craig Andreiko/Eric Chapoulaud)**a. Accomplishments / Status****b. Goals For March****c. Major Project Milestone**

- ⊙ Re-evaluate project once 3D scanning & jig fabrication is completed.

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: April 8, 1997

To: Dan Even

Subject: **Monthly Report – March 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
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Eckhard Vogel  
Don Frei  
  
Craig Andreiko  
Kerry Darney  
Farrokh Farzin-Nia  
Gary Garman  
Randy Hacker  
Jason Lee  
Mark Payne  
Tom Selkee  
Hamid Sheikh  
Raymond Thornton  
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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****TYPE II (Outside Vendor)**

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BII-1. Reverse-Curve *Copper Ni-Ti* Archwires

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BII-2. Disinfectant Solution

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BII-3. Titanium Buccal Tube - MIM Process

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**C. PRODUCT IMPROVEMENT / MANUFACTURING SUPPORT ACTIVITIES**

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C-I. *AOA* (Laboratory) Engineering Support

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C-II. CE Marking

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C-III. Bracket Placement Process Improvement

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C-IV. Gold Bracket Alternative Vendor

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C-V. AEZ / ETM Instrument Support

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C-VI. Improved Optimesh

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**D. OTHER DEPARTMENT ACTIVITIES**

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D-I. Capital Appropriation Requests

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D-II. Custom Braze

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**A. RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS**

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AI-1. Post Remover Kit

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AI-2. Buchanan Hand Plugger

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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****B. RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****TYPE I** (Built In-House)**BI-2. CustomRx CUSTOM LABIAL APPLIANCE SYSTEM** (Project 853-E Craig Andreiko/Eric Chapoulaud)**a. Lab Reopening** (Craig Andreiko / Eric Chapoulaud)**1) Accomplishments / Status**

- ☒ A Plan describing the activity for this project has been written and submitted for approval. It intends to allow us to produce 5 clinical cases in the next six months using the new 3D JIGS, that will be clinically tested in a closeby office.
- ☒ According to this plan, a case of 5x5 for the uppers of the PK Thomas model has been manually designed: Wire and Brackets position and characteristics. A new appliance design software (codename Atlantis) was created allowing the tooth long axis definition and Wire design.

**2) Goals For April**

- ☐ Design of the 3D JIG tooth registration surface component.
- ☐ Design of the 3D JIG bracket attachment component.
- ☐ Manufactruing of the 3D JIGS for the 5x5 uppers of the PK Thomas Model.
- ☐ Implementation of the corresponding software.

**3) Major Project Milestones**

- © 3D JIG Design review: 5/15/97

**b. 3D Digitizing** (Eric Chapoulaud)**1) Accomplishments / Status**

- ☒ No development were implemented this month.

**2) Goals For April**

- ☐ No new development anticipated this month.

**3) Major Project Milestones**

- © Mandibular jaw of the PK Thomas model scanned: 5/18/97.

**BI-3. CustomRx CUSTOM LINGUAL APPLIANCE SYSTEM** (Project 953-E; Craig Andreiko)**a. Accomplishments / Status**

- ☒ No development were implemented this month.

**b. Goals For April**

- ☐ No new development anticipated this month.

**c. Major Project Milestone**

- © Re-evaluate project once 3D scanning & jig fabrication is completed.

**Ormco****Interoffice Memorandum**

---

From: Albert Ruiz-Vela

Date: May 9, 1997

To: Dan Even

Subject: **Monthly Report – April 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
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Eckhard Vogel  
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Dan Dixon  
Brian Hulan  
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Farrokh Farzin-Nia  
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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****CustomRx CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)****a. Lab Reopening (Craig Andreiko)****1) Accomplishments / Status**

- ☒ Following the 6 months plan, the 5x5 PK Thomas Case has been created: We have manually designed a wire the fits the case and obtained bracket characteristics (Torque, In/Out and RIS). The wire was milled using a Stainless-steel plate (0.021).
- ☒ A new Jig design software was created, using the scanned images and the tooth definition (Long Axis and Section). As a result a first Jig was produced for the upper right cuspid, with correct precision. A prototype mounting was done by bonding the Jig to a bracket with a wire attachment part. This set produced an acceptable fit and positioning precision.
- ☒ Jig fit problems have been identified for the upper right lateral.

**2) Goals For May**

- ☐ Improving the Jig design and manufacturing precision particularly for the Central and lateral.
- ☐ Creation of a 5x5 case of Jigs.

**3) Major Project Milestones**

- ⊙ 3D JIG Design review: 5/31/97

**b. 3D Digitizing (Eric Chapoulaud)****1) Accomplishments / Status**

- ☒ No development was taken this month.

**2) Goals For May**

- ☐ No development anticipated this month.

**3) Major Project Milestones**

- ⊙ Mandibular jaw of the PK Thomas model scanned: 6/22/97.

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: June 10, 1997

To: Dan Even

Subject: **Monthly Report – May 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Steve Tomassi  
Dan Dixon  
Brian Hulan  
Henry Hulan  
  
Farrokh Farzin-Nia  
Mark Payne  
Raymond Thornton  
Ray Wong  
  
Bob Davis  
Ted Driefuss  
Grace Kibler  
Colin Matheson  
Steve Paskin  
  
Tom McCarthy  
Joe Rotino  
Mary Warren

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## ORTHODONTIC PRODUCTS

## RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS

*CustomR<sub>x</sub>* CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)

## a. Lab Reopening (Craig Andreiko)

## 1) Accomplishments / Status

- ☒ Improvement of the JIG Design for the Upper Lateral: Modification of the lingual surface to remove interferences, Modification of the manufacturing software to improve precision of the milling paths.
- ☒ Improvement of the visualization software: Modification of the sections functionality to allow easier debugging of the Jig design and manufacturing software.

## 2) Goals For June

- ☐ Improve the Jig design and manufacturing for the Upper Lateral Jig.
- ☐ Creation of 5x5 case of Jigs.

## 3) Major Project Milestones

- © 3D JIG Design review: 6/30/97

## b. 3D Digitizing (Eric Chapoulaud)

## 1) Accomplishments / Status

- ☒ No development was done this month.

## 2) Goals For June

- ☐ No development is anticipated this month.

## 3) Major Project Milestones

- © Mandibular jaw of the PK Thomas model scanned: 6/22/97.

## c. Bracket Fabrication (Eric Chapoulaud)

## 1) Accomplishments / Status

- ☒ Reception and Set-up of the Wax patterns manufacturing machine from SANDERS prototype Inc: "Model Maker Pro".
- ☒ Produced wax parts of Upper Lateral brackets in different sizes: real life, scale 10 and currently scale 20.
- ☒ During the parts manufacturing, we have been adjusting the machine parameters to our laboratory conditions and to our parts size, shape and accuracy.

## 2) Goals For June

- ☐ Training at SANDERS for E. Chapoulaud and L. Phaneuf.
- ☐ Continue adjusting parameters of the machine for better precision and reliability
- ☐ Produce customized wax patterns of brackets and JIGS, using the Elan Software.

## 3) Major Project Milestones

- ©

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## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: July 21, 1997

To: Dan Even

Subject: **Monthly Report – June 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Steve Tomassi  
Dan Dixon  
Brian Hulan  
Henry Hulan  
  
Farrokh Farzin-Nia  
Mark Payne  
Raymond Thornton  
Ray Wong  
  
Bob Davis  
Ted Driefuss  
Grace Kibler  
Colin Matheson  
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Tom McCarthy  
Joe Rotino  
Mary Warren

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- ☒ A set of 5x5 Jigs have been manufactured after accuracy improvement of the manufacturing software. These jigs have been manually mounted with to their respective brackets. This case reveals good fit accuracy to the model.
- ☒ The next step is to attach the brackets to the jigs. For that purpose, we cannot easily use the old Elan vanilla brackets. We think that the attachment would be best with a cylindrical vertical slot. We have decided to create these brackets by software and use the Rapid prototyping machine to manufacture them.
- ☒ Software modules to create brackets from the dimensions, torque, In/out and RIS was started from a previous prototype written in 1995.

**2) Goals For July**

- ☐ Improve the bracket design software and manufacture brackets with cylindrical vertical slot.
- ☐ Creation of 5x5 case of Jigs and brackets.

**3) Major Project Milestones**

- © 3D JIG Design review: 8/31/97

**b. 3D Digitizing (Eric Chapoulaud)****1) Accomplishments / Status**

- ☒ No development was done this month.

**2) Goals For July**

- ☐ No development is anticipated this month.

**3) Major Project Milestones**

- © Mandibular jaw of the PK Thomas model scanned: August 97.

**c. Bracket Fabrication (Eric Chapoulaud)****1) Accomplishments / Status**

- ☒ Continued producing parts with the MM6 Pro.

**2) Goals For July**

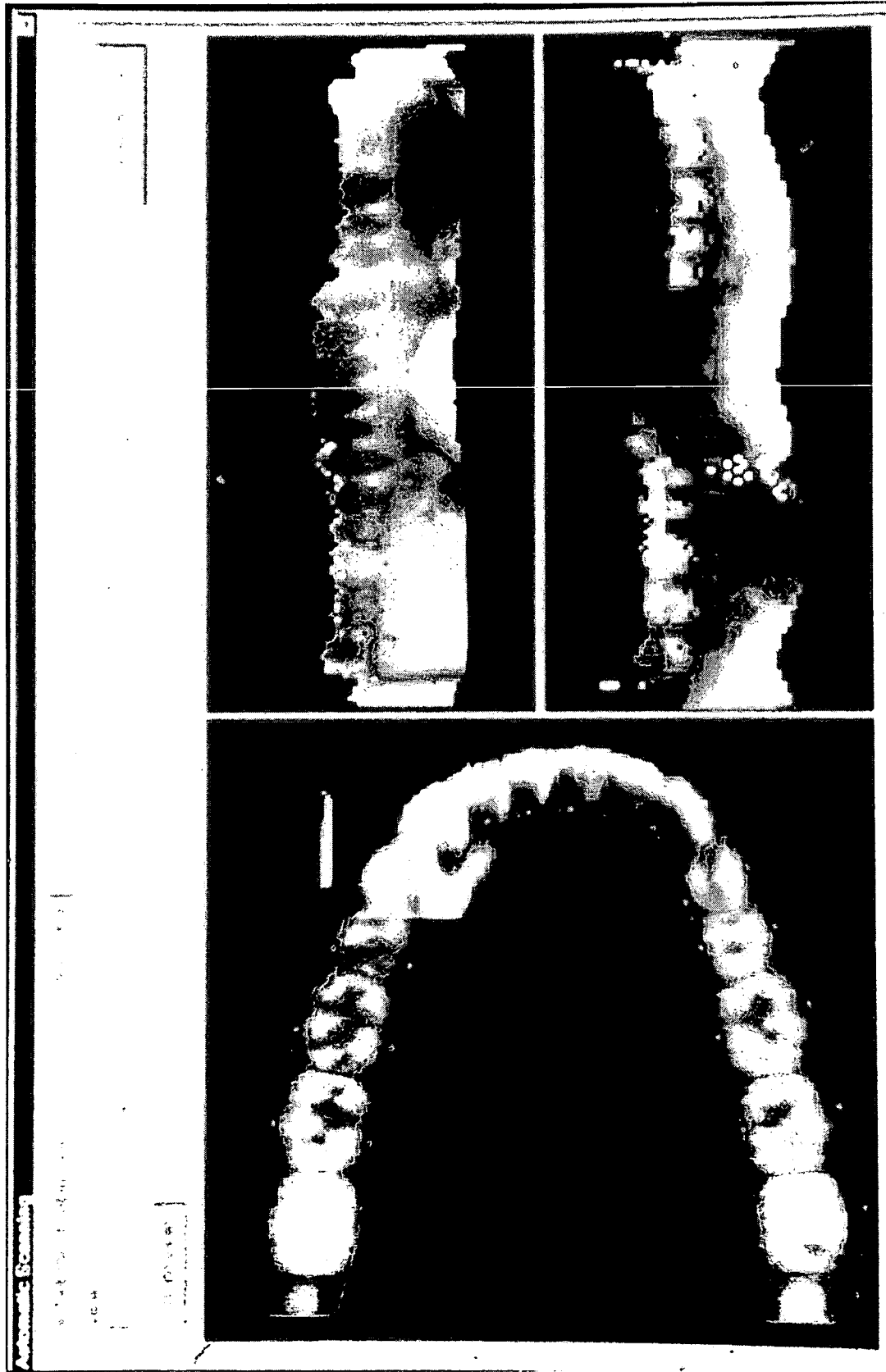
- ☐ Training at SANDERS for E. Chapoulaud and L. Phaneuf.
- ☐ Installation of the MMII, upgrade version of the MM6 Pro. Upgrade of the SANDERS software.

**3) Major Project Milestones**

- ©

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EXHIBIT N



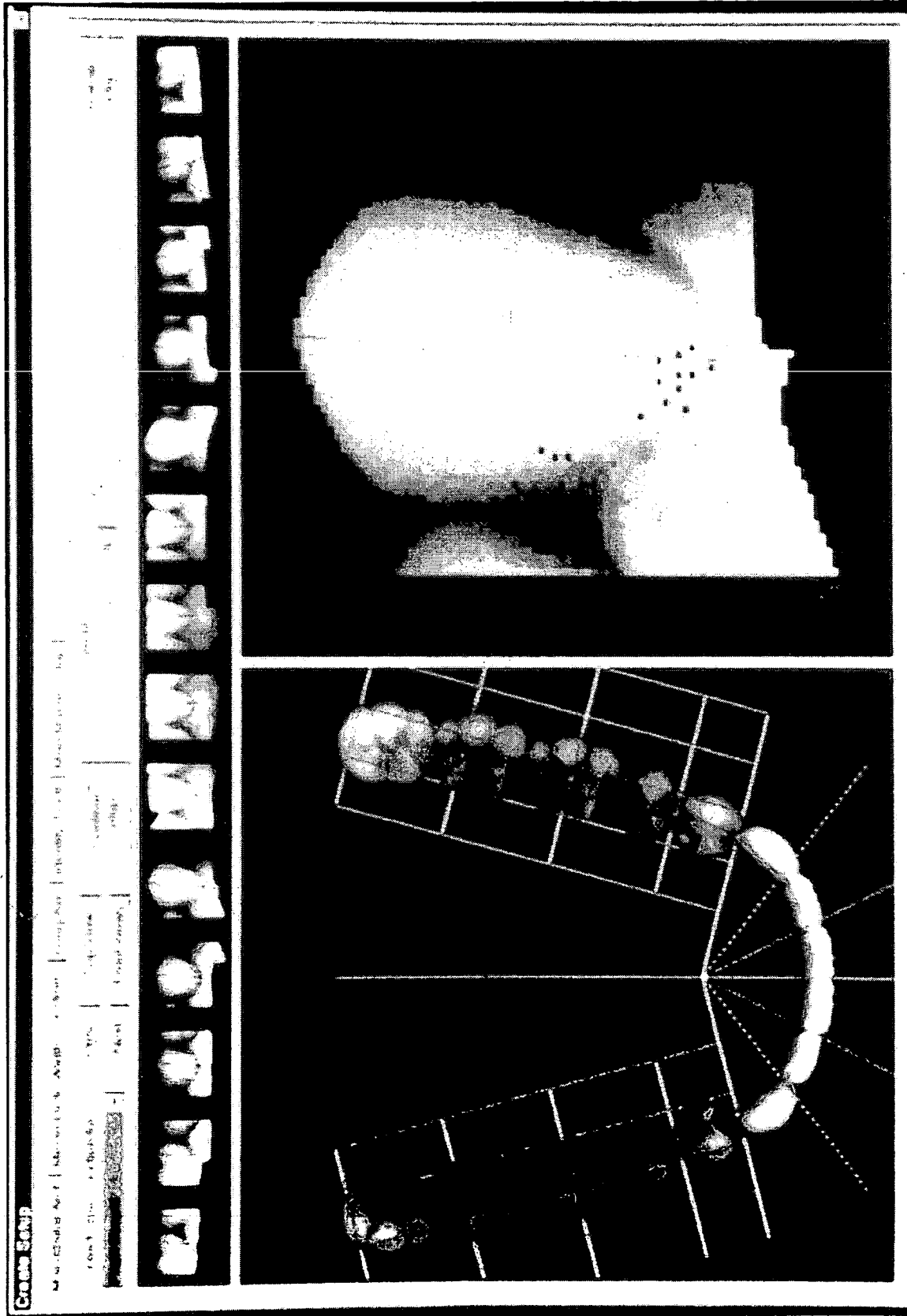
(Fig. 3A)

EXHIBIT N



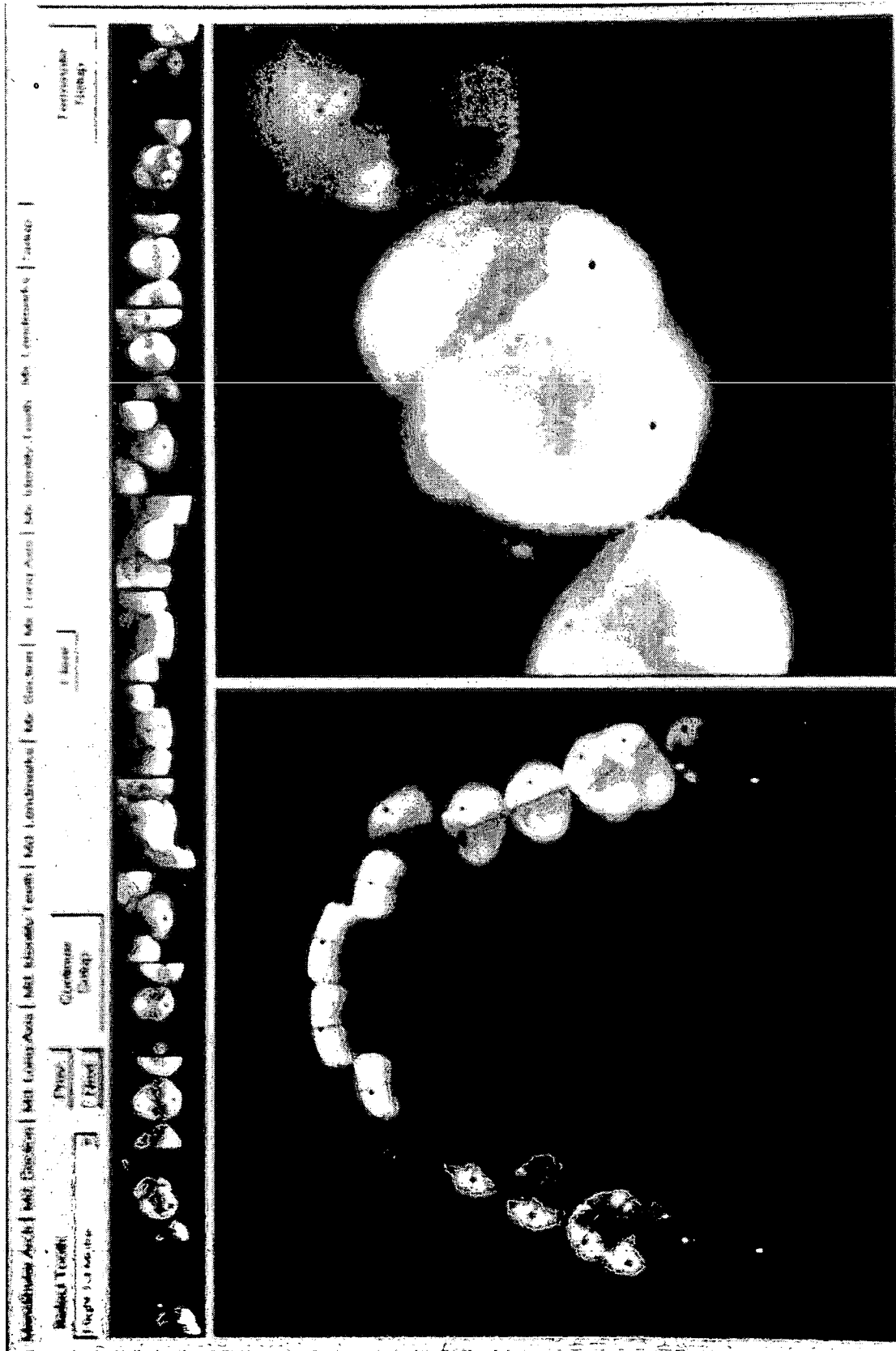
(Fig. 3B)

EXHIBIT N



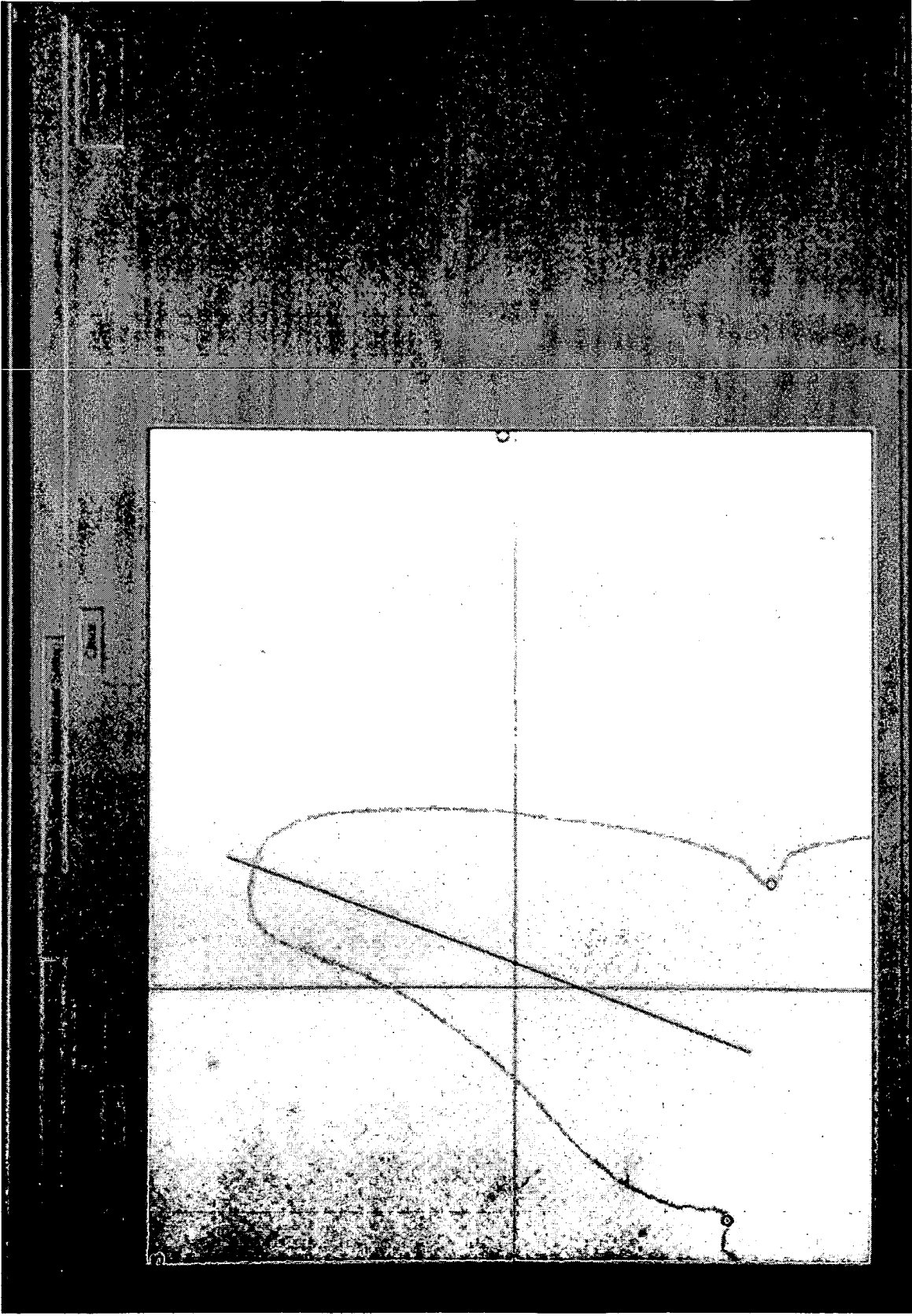
(Fig. 4)

# EXHIBIT N



(Fig. 4B)

EXHIBIT N

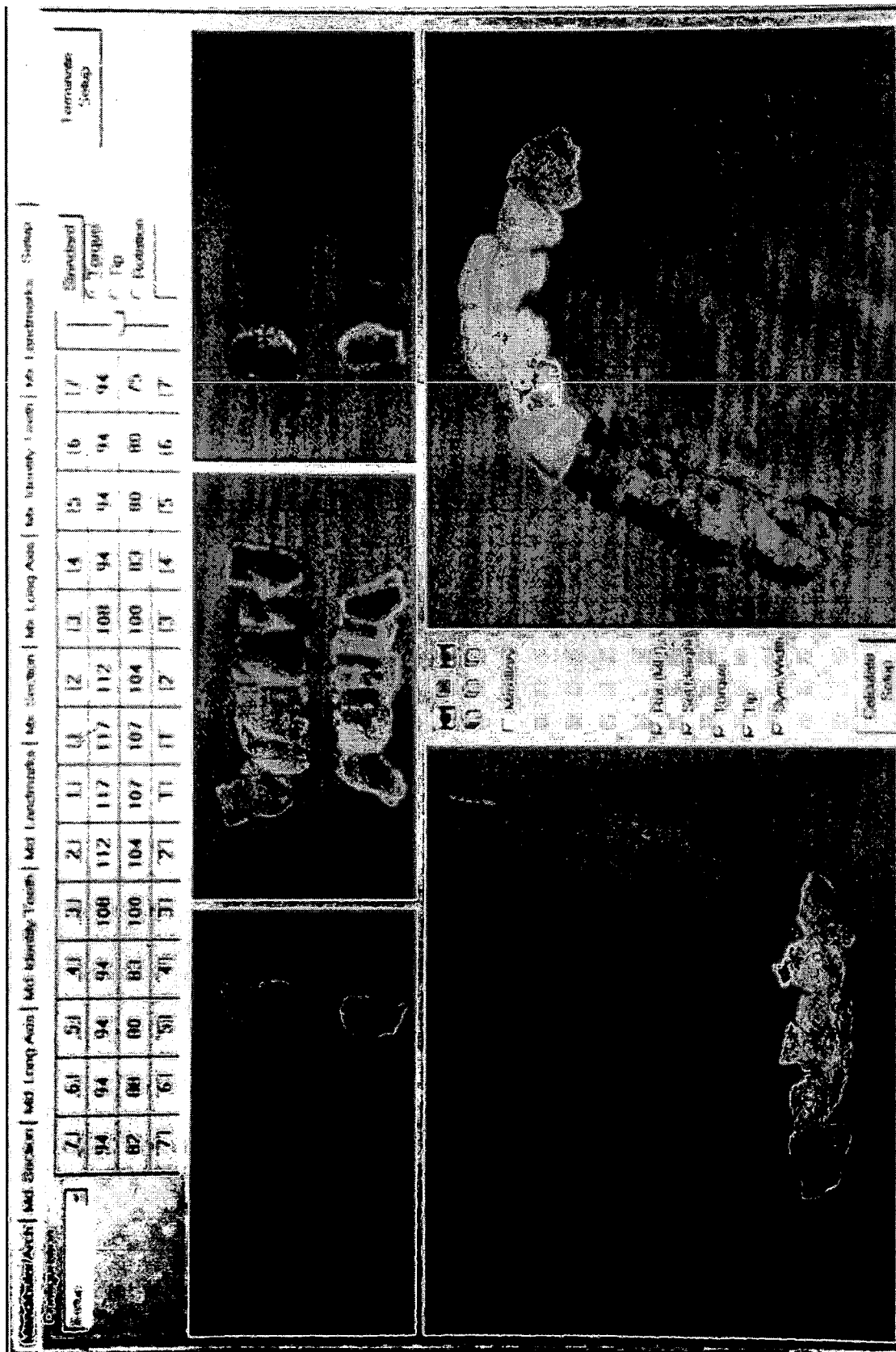


(Fig. 4C)



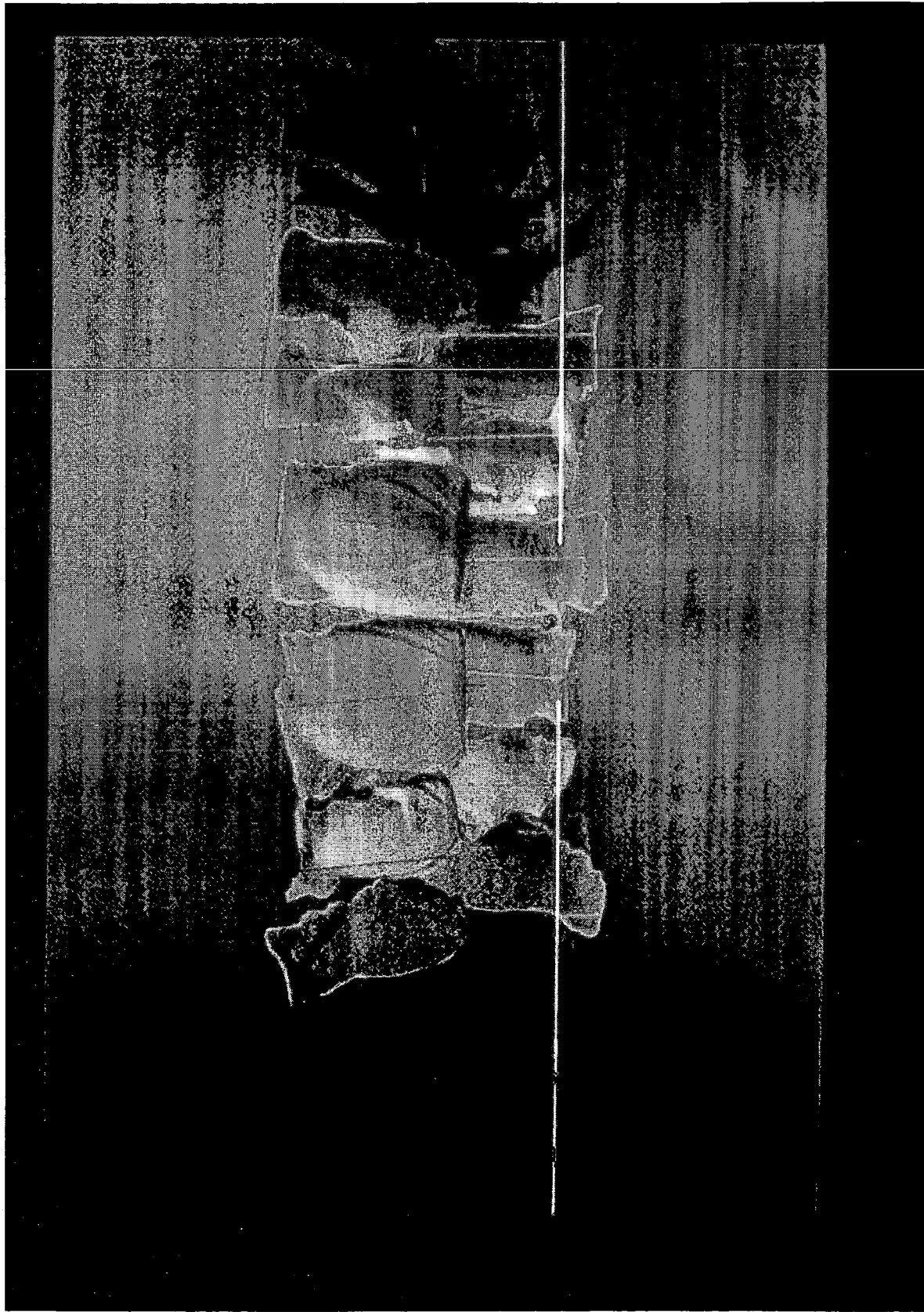
(Fig. 5)

EXHIBIT N



(Fig. 5A)

EXHIBIT N

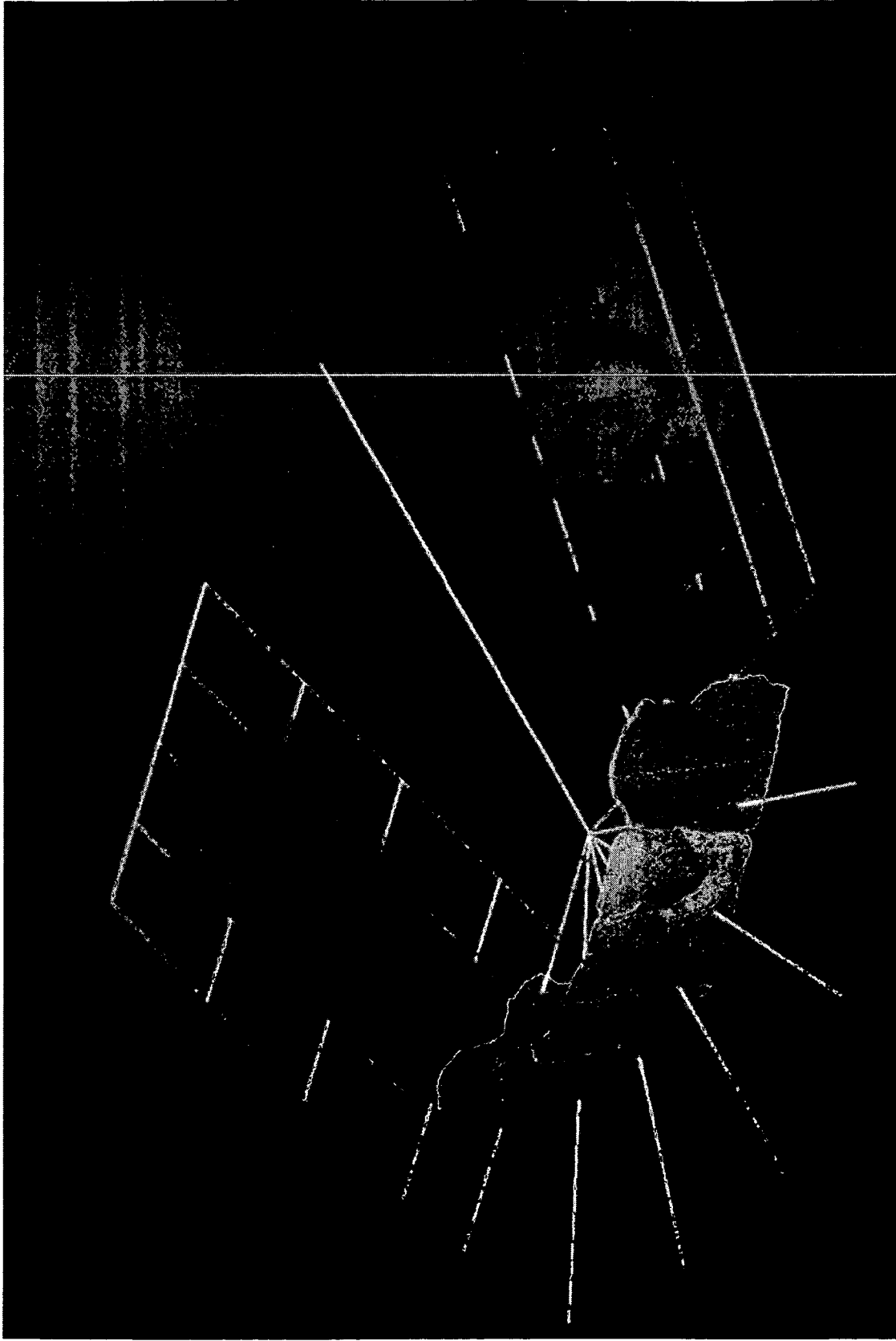


(Fig. 5B)

[illegible]

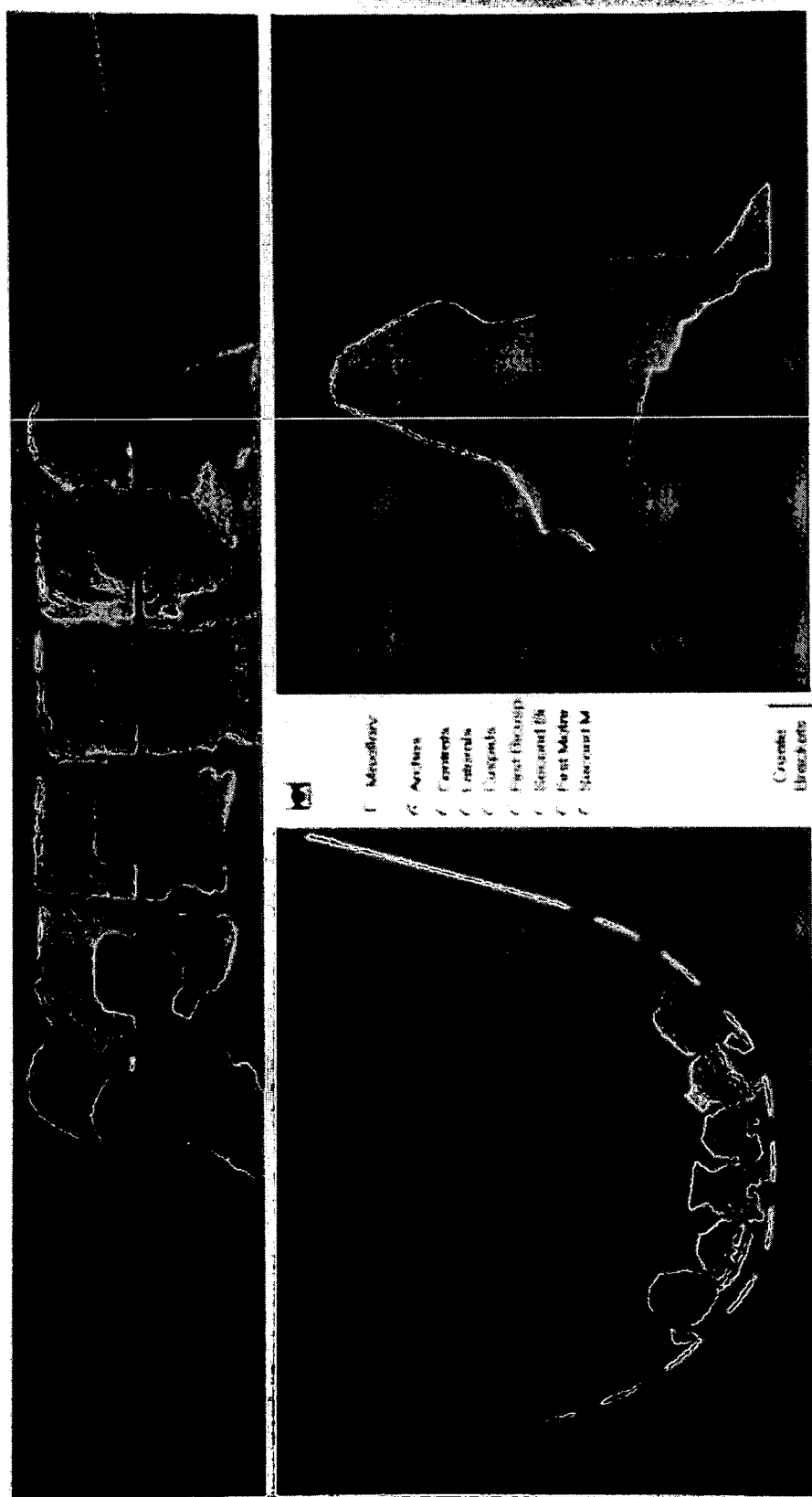
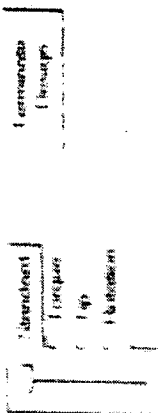
(Fig. 5C)

EXHIBIT N



(Fig. 5D)

**Design Vision: Design Methodology Framework**  
**Grading**



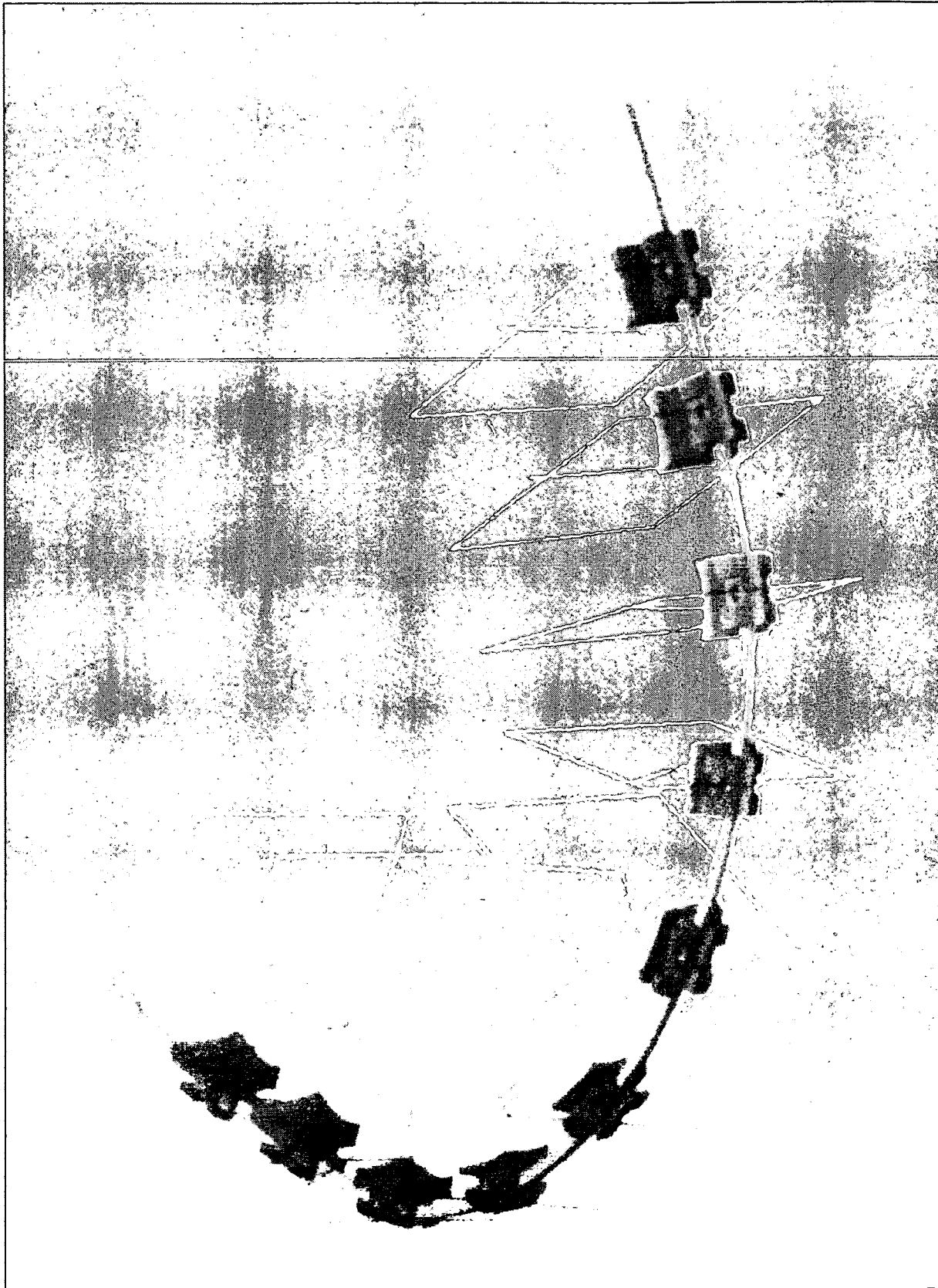
(Fig. 5E)

EXHIBIT N



(Fig. 5F)

EXHIBIT N



(Fig. 5G)

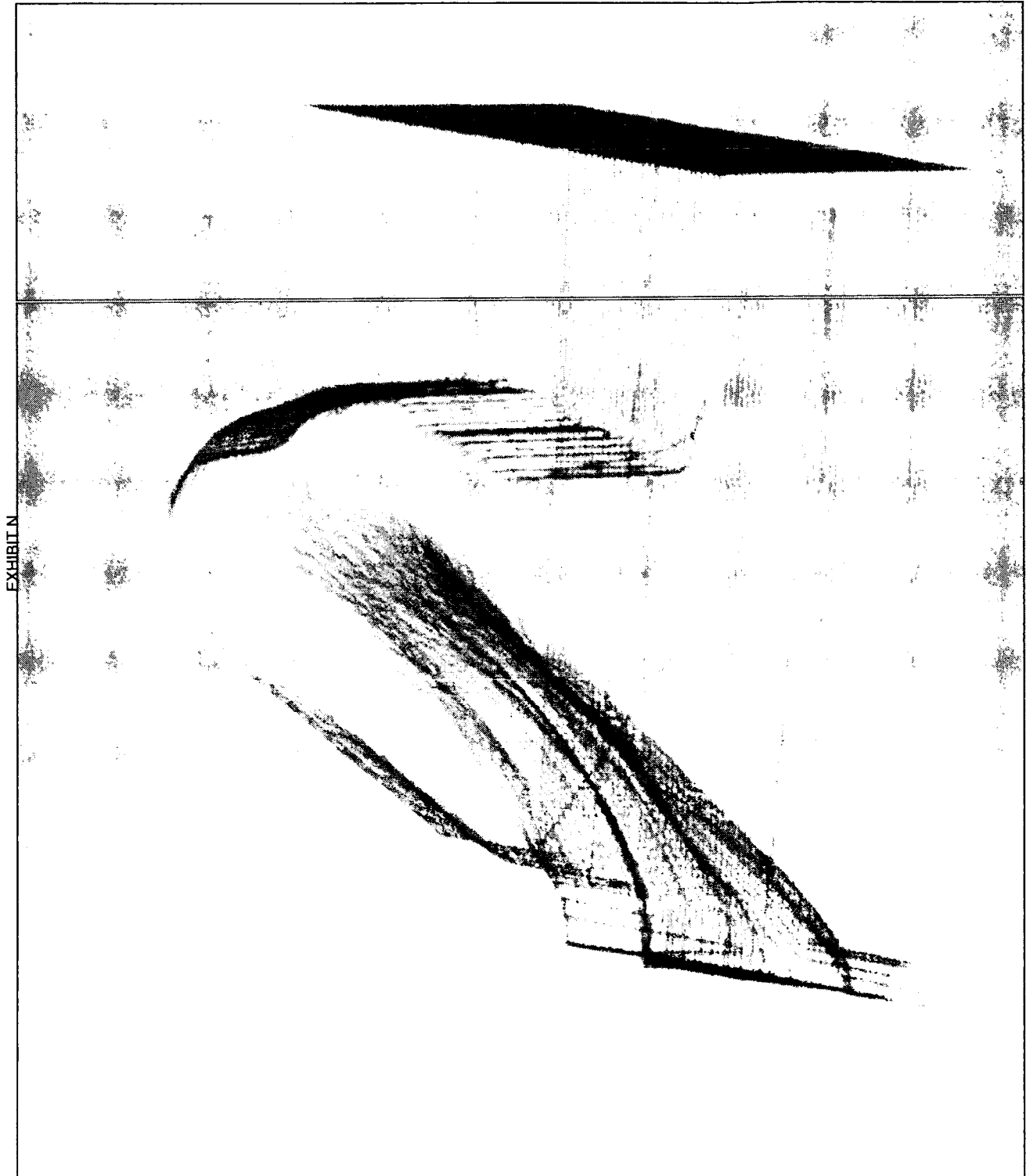
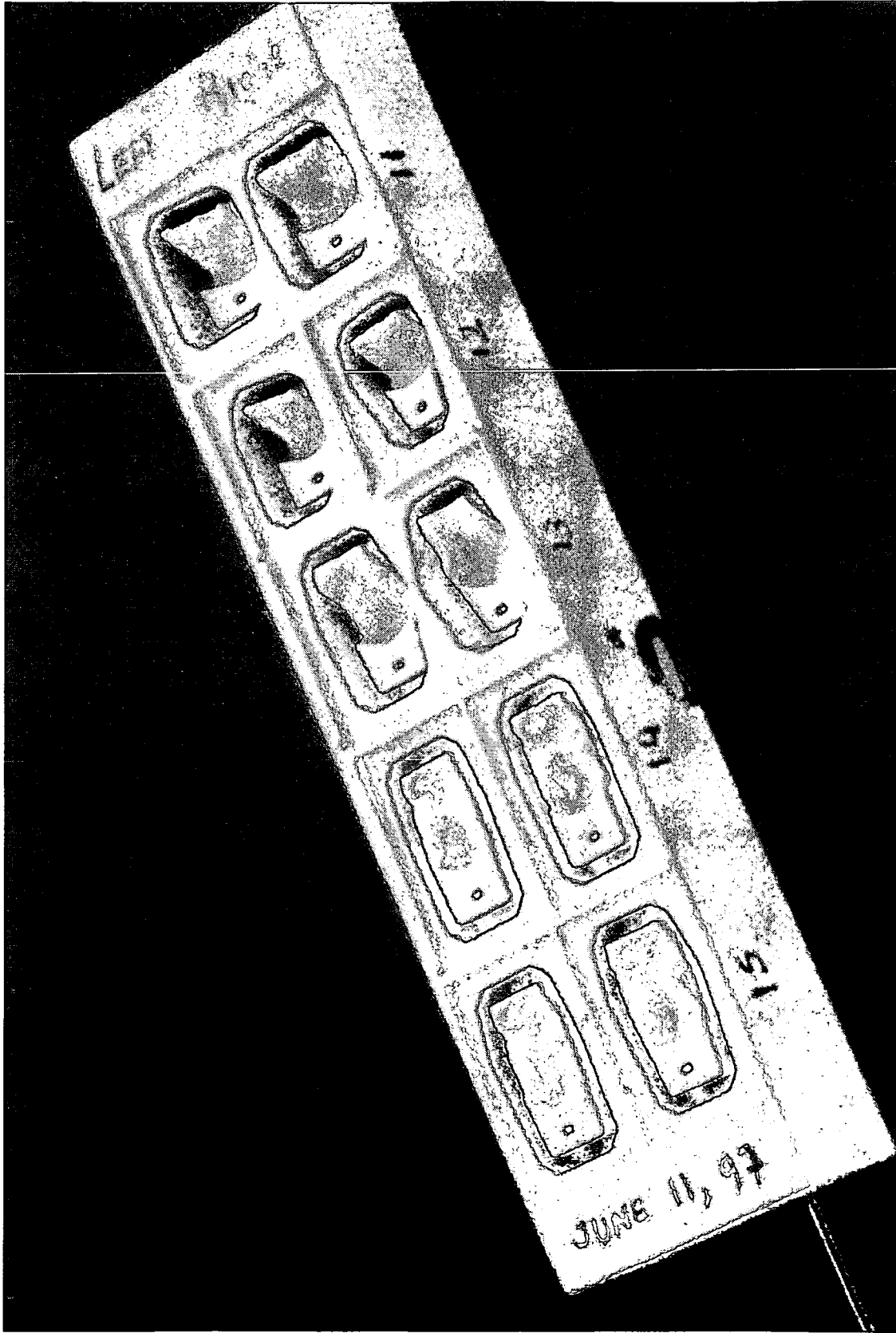


EXHIBIT N

(Fig. 6A)

EXHIBIT N



(Fig. 6A\_1)

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
PLEASE FILL IN THE FOLLOWING FOR YOUR EXPENSE REPORT (U.S. \$, only)																										
2	Location/Profit Ctr											1	300-	Sydon Dental Specialties, Inc.												
4	Your Name	Eric CHAPOULAUD										2	350-	Ker Corporation												
5	Department Name	R&D										3	301-	Ormco												
6	Department #	8010										4	301-	Ormco												
7	Business Purpose	Model Maker II Training										5	301-	Ormco												
8	Exp. Report begin date	7/15/1997																								
9	Exp. Report end date	7/18/1997																								
10	Company automobile?	(yes or no)																								
11	Odometer begin	0																								
12	Odometer end	0																								
13	Business miles	0																								
14	Check Payable to:	SAME										(Type SAME or name of individual)														
15	Temporary Cash Advance?	Y										(If yes or Y, enter amount -)														
16	Co. Charge Card Usage?											(If yes or Y, enter amount -)														
17	Prepaid Transportation?											(If yes or Y, enter amount -)														
18																										
19																										
20	After filing in all the above information, please complete the expense report as normal.																									
21	All accounts in OTHER column will default to TRAVEL, unless otherwise designated in																									
22	account coding at bottom, right of Expense Report. There are three (3) account number																									
23	codings available. Use any of the (3) and type in the \$ amount to that code. The																									
24	worksheet should automatically recalculate TRAVEL.																									
25																										
26	If you have any problems or comments call ext. #7431																									
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28	To set TITLES, position ROW 36 as your top line. Position cursor in CELL B39																									
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38	ACCOUNT NO.																									
39																										
40	DAY	PLACE	MILES	GAS & OIL	EXPENSE (explain)	AIR/RAIL	PARK TAXI	MEALS (SELF)	ROOM	PHONE/ FAX	POSTAGE	ENTER-TAINTMENT (explain)	OTHER (explain)	TOTAL	REMARKS (Auto Expense, Entertainment & Other require full explanation)											
41	15-Jul	LAX	30					1.29						0.00	Per. Auto Travel to LAX											
42	15-Jul	BOSTON												1.29	breakfast at LAX											
43	15-Jul	BOSTON						3.45						3.95	Computer Magazines											
44	15-Jul	BOSTON			0.50									0.50	Toll Road											
45	15-Jul	BOSTON					12.00							12.00	Parking Boston											
46	15-Jul	BOSTON			0.50									0.50	Toll Road											
47	17-Jul	BOSTON			0.50									0.50	Toll Road											
48	17-Jul	BOSTON			0.50									0.50	Toll Road											
49	17-Jul	BOSTON			0.50									0.50	Toll Road											
50	16-Jul	BOSTON			2.00			3.29						2.00	breakfast at Airport											
51	18-Jul	BOSTON																								
52	18-Jul	BOSTON																								
53	18-Jul	BOSTON							194.25					143.41	ALAMO Rent-a-Car Rental 7/15/97 - 7/18/97											
54	18-Jul	LAX					35.00							35.00	FAIRFIELD Inn MERRIMACK 3 Nights 7/15/97 - 7/17/97											
55	18-Jul	LA	30											0.00	Parking LAX											
56														0.00	Per. Auto Travel from LAX											
57														0.00												
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64														0.00												

Ormco

TRAVEL EXPENSE STATEMENT

U.S. Dollars

The company will not issue expense statements for personal tax purposes. An extra copy should be retained for your records.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
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Ormc

TRAVEL EXPENSE STATEMENT

7/15/1997 THROUGH 7/18/1997

STATEMENT PERIOD

U.S. Dollars

The company will not issue expense statements for personal purposes. An extra copy should be retained for

U.S. Dollars

entertainment

phone/fax

travel

lodgings

meals (self)

auto expense

postage

temp. advance

supplies/office

60	COST/MILE	\$0.24	\$14.40	TRANSPORTATION PREPAID BY COMPANY	CO. BUSINESS	\$0.00	\$14.40	415.54	301-301-8010	71800-840	000000	0.00	
69	TOTAL MILES	60	\$0.24	TRANSPORTATION PREPAID BY COMPANY	CO. BUSINESS	\$0.00	\$14.40	415.54	301-301-8010	71810-840	000000	0.00	
70	TOTAL EXPENSES	\$0.00	\$4.50	\$0.00	\$61.40	\$8.03	\$194.25	\$0.00	\$0.00	\$0.00	\$147.36	0.00	
71	TOTAL EXPENSES	\$0.00	\$4.50	\$0.00	\$61.40	\$8.03	\$194.25	\$0.00	\$0.00	\$0.00	\$147.36	0.00	
72	TOTAL EXPENSES	\$0.00	\$4.50	\$0.00	\$61.40	\$8.03	\$194.25	\$0.00	\$0.00	\$0.00	\$147.36	0.00	
73	TOTAL EXPENSES	\$0.00	\$4.50	\$0.00	\$61.40	\$8.03	\$194.25	\$0.00	\$0.00	\$0.00	\$147.36	0.00	
74	MAKE CHECK PAYABLE TO:	Eric CHAPOULAUD											
75	COMPANY CHARGE CARD:												
76	PREPAID TRANSPORTATION												
77	SIGNATURE												
78	DATE												
79	EMPLOYEE												
80	COMPANY												
81	APPROVAL												
82	Mileage Begin	0											
83	Mileage end	0											
84	AUDITED												

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PLEASE FILL IN THE FOLLOWING FOR YOUR EXPENSE REPORT (U.S. \$, only):																								
1	Location/Profit Ctr																							
2	Your Name																							
3	Department Name																							
4	Department #																							
5	Business Purpose																							
6	Exp Report begin date																							
7	Exp Report end date																							
8	Company automobile?																							
9	Odometer begin																							
10	Odometer end																							
11	Business miles																							
12	Check Payable to																							
13	Temporary Cash Advance?																							
14	Co. Charge Card Usage?																							
15	Prepaid Transportation?																							
16																								
17																								
18																								
19																								
20	After filling in all the above information, please complete the expense report as normal.																							
21	All amounts in OTHER column will default to TRAVEL, unless otherwise designated in																							
22	account coding at bottom, right of Expense Report. There are three (3) account number																							
23	codings available. Use any of the (3) and type in the \$ amount to that code. The																							
24	worksheet should automatically recalculate TRAVEL																							
25																								
26	If you have any problems or comments call ext. #1431																							
27																								
28	To set TITLE, position ROW 36 as your top line. Position cursor in CELL B39.																							
29	Using menu: Window Freeze Panes																							
30	To remove: use Window Unfreeze Panes																							
31																								
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33	Eric CHAPOULAUD																							
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36	Depart. Name R&D																							
37	Business Purpose Model Maker II Installation																							
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ACCOUNT NO.	71825	71820	71820	71840	71830	71810	71780	71800	OTHER	TOTAL	REMARKS				
DAY	PLACE	MILES	GAS & OIL	EXPENSE	AIR/RAIL	PARK TAXI	MEALS (SELF)	ROOM	PHONE/FAX	POSTAGE	TAINMENT	ENTER-TAINMENT	OTHER	TOTAL	REMARKS
21-40	CA													30.22	Computer Extension Cables
41														0.00	
42														0.00	
43														0.00	
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45														0.00	
46														0.00	
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TRAVEL EXPENSE STATEMENT	
THROUGH 7/21/1997	U.S. Dollars
STATEMENT PERIOD	
The company will not issue expense statements for personal tax purposes. An extra copy should be retained for your records.	

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31	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
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83																									
84																									

Eric CHAPOULAUD

Depart. Name

Business Purpose:

Model Maker II Installation

8010

7/21/1997

THROUGH 7/21/1997

STATEMENT PERIOD

U.S. Dollars

The company will not issue expense statements for personal tax purposes. An extra copy should be retained for

TRAVEL EXPENSE STATEMENT

PERSONAL MILEAGE ALLOWANCE

TRANSPORTATION PREPAID BY COMPANY - CO. BUSINESS

CASH ADVANCES

COMPANY CHARGE CARD

PREPAID TRANSPORTATION

EMPLOYEE [X]

COMPANY [ ]

0

Mileage begin

0

Mileage end

0

Mileage business

30.22

TOTAL EXPENSES

30.22

entertainment

phone/fax

travel

lodgings

meals (self)

auto expense

postage

temp. advance

(71108-) supplies/office

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: July 30, 1997

To: Dan Even

Subject: **Monthly Report – July 1997  
Product Development  
& Engineering**

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Steve Tomassi  
Dan Dixon  
Brian Hulan  
Henry Hulan  
  
Farrokh Farzin-Nia  
Mark Payne  
Raymond Thornton  
Ray Wong  
  
Bob Davis  
Ted Driefuss  
Grace Kibler  
Colin Matheson  
Steve Paskin  
  
Tom McCarthy  
Joe Rotino  
Mary Warren

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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****CustomRx CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)****a. Lab Reopening (Craig Andreiko)****1) Accomplishments / Status**

- ☒ Debugging of the bracket design software with cylindrical vertical slot.
- ☒ A software module to automatically create a brackets tree for the 5x5 case was developed and tested with the SANDERS MM6 Pro machine. This software creates a '.STL' file from the Setup model file that contains the brackets models.
- ☒ The Bracket design has been also improved to include constant pad thickness, lower gingival wing, rounded corners on the pad.

**2) Goals For August**

- ☐ Improve the brackets tree design, manufacture tree samples and cast them.
- ☐ Creation of 5x5 case of Jigs and brackets.

**3) Major Project Milestones**

- © 3D JIG Design review: 8/31/97

**b. 3D Digitizing (Eric Chapoulaud)****1) Accomplishments / Status**

- ☒ No development was done this month.

**2) Goals For August**

- ☐ No development is anticipated this month.

**3) Major Project Milestones**

- © Mandibular jaw of the PK Thomas model scanned: August 97.

**c. Bracket Fabrication (Eric Chapoulaud)****1) Accomplishments / Status**

- ☒ Training at SANDERS for E. Chapoulaud and L. Phaneuf was accomplished.
- ☒ Installation of the MMI, upgrade version of the MM6 Pro. Intermittent problems on the building jet was discovered. A new jet will be sent by SANDERS to replace it.
- ☒ Upgrade of the SANDERS Software.

**2) Goals For August**

- ☐ New Upgrade of the SANDERS software.
- ☐ Installation of a Printer Server, that will be used as a Milling machine Server also.

**3) Major Project Milestones**

- ©

## Interoffice Memorandum

---

From: Albert Ruiz-Vela

Date: September 1, 1997

To: Dan Even

Subject: Monthly Report – August 1997  
Product Development  
& Engineering

cc: Mark Clineff  
Glenn Lyon  
Mark Vigna  
Eckhard Vogel  
Steve Tomassi  
Dan Dixon  
Brian Hulan  
Henry Hulan  
  
Farrokh Farzin-Nia  
Mark Payne  
Raymond Thornton  
Ray Wong  
  
Bob Davis  
Ted Driefuss  
Grace Kibler  
Colin Matheson  
Steve Paskin  
  
Tom McCarthy  
Joe Rotino  
Mary Warren

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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****BRACKETS / BUCCAL TUBES**

*CustomR<sub>x</sub>* CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)

- a. Lab Reopening (Craig Andreiko)
  - 1) Accomplishments / Status
    - ☒ The design software for custom brackets was implemented in the Set-up software. A set of 10 brackets for the uppers 5x5 of the PK Thomas case was calculated. These developments were made necessary in order to attach the bracket to the jig, using real tip values, through a vertical cylindrical slot, which could not be done otherwise.
    - ☒ Software modules were added to our manufacturing program to automatically create a tree assembling the 10 brackets, and create a '.STL' file suitable for the Model Maker wax printer.
    - ☒ Attempt were made to print this tree with the new Model Maker II. Note: The vertical cylindrical slot has a diameter of 0.032 in. It was printed correctly and the support material could be removed easily from it without any manual operation.
  - 2) Goals For September
    - ☐ Create the Lower Jaw case using the newly scanned images. Implement new modules in the set-up programs to create the mandibular set-up and adapt the occlusion with the maxillary set-up.
    - ☐ Successfully print the upper brackets tree and cast it.
    - ☐ Manufacture the new jigs with the new attachment.
    - ☐ Assemble the upper case, using casted brackets and new jigs.
  - 3) Major Project Milestone
    - © 3D JIG Design Review: September 97
- b. 3D Digitizing (Eric Chapoulaud)
  - 1) Accomplishments / Status
    - ☒ According to the plan, a 3D Scan of the PK Thomas case lower Jaw has been acquired, using existing software.
  - 2) Goals For September
    - ☐ Scan a real clinical case using the same software.
  - 3) Major Project Milestone
    - © Clinical case scan: September 97.
- c. Bracket Fabrication (Eric Chapoulaud)
  - 1) Accomplishments / Status

**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION**

- ☒ A new Build jet and heated line was sent by Sanders to replace our failing one. After replacement, we have been able to print a tree without any significant problems.
- 2) Goals For September
  - ☐ Upgrade the model maker software.
  - ☐ Print parts to check for accuracy and reliability.
- 3) Major Project Milestone
  - © Reliable printing operation: October 97.

ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION
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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION****ORTHODONTIC PRODUCTS****RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS****BRACKETS / BUCCAL TUBES**

*CustomR<sub>x</sub>* CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)

- a. Lab Reopening (Craig Andreiko)
  - 1) Accomplishments / Status
    - ☒ Scanned image of the PK Thomas Case lower Jaw
    - ☒ Created new software modules to calculate the set-up of the lower jaw: the mandibular skeletal bone can be defined by the operator along with the mesio-distal width of the lowers 7x7, using photographic recomposition of the scanned model.
    - ☒ Successfully printed upper bracket tree (3 samples) and had them setup for casting.
  - 2) Goals For October
    - ☐ Implement new modules in the set-up programs to create the mandibular set-up and adapt the occlusion with the maxillary set-up.
    - ☐ Test the casting process of the bracket trees.
    - ☐ Manufacture the new jigs with the new attachment.
    - ☐ Assemble the upper case, using casted brackets and new jigs.
  - 3) Major Project Milestone
    - ⊙ Lower/Uppers Setup for the PK Thomas case: November 97
- b. 3D Digitizing (Eric Chapoulaud)
  - 1) Accomplishments / Status
    - ☒ No Action this month.
  - 2) Goals For October
    - ☐ A malpositioned case will be scanned to be used as test data with the new set-up software being developed.
  - 3) Major Project Milestone
    - ⊙ First Clinical case scan: November 97.
- c. Bracket Fabrication (Eric Chapoulaud)
  - 1) Accomplishments / Status
    - ☒ Software upgrade of the ModelMaker II Driver was installed, along with modifications in the parameters file. It improved jet reliability and parts quality.
  - 2) Goals For October
    - ☐ Print parts to check for accuracy and reliability.

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- 3) Major Project Milestone
  - © Reliable printing operation: October 97.

## Interoffice Memorandum

From: Eric Chapoulaud

Date: October 6, 1997

To: Albert Ruiz-Vela

Subject: Monthly Report – September 1997  
Product Development  
& Engineering

INFORMATION –

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ORTHODONTIC PRODUCTS

RESEARCH AND EXPLORATORY PRODUCT INVESTIGATIONS

*CustomRx* CUSTOM LABIAL APPLIANCE SYSTEM (Project 853-E Craig Andreiko/Eric Chapoulaud)

## a. Lab Reopening (Craig Andreiko)

## 1) Accomplishments / Status

- ☒ Our set-up program is now able to design the mandibular set-up, using scanned 3D images of the lower jaw.
- ☒ Maxillary Case assembly was halted due to unreliable operation of the 3D wax printer. Priority was set to develop the set-up software.

## 2) Goals For November

- ☐ Improve the set-up design rules using our new 3D approach, and verify these new rules with our PK Thomas case and the standard mal-positioned case.
- ☐ Adapt the appliance design software to the new set-up functions.
- ☐ Design and manufacture Jigs for the Mandibular set-up.
- ☐ Improve the teeth 3D modelisation for appearance and speed.

## 3) Major Project Milestone

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9710\_rec.doc

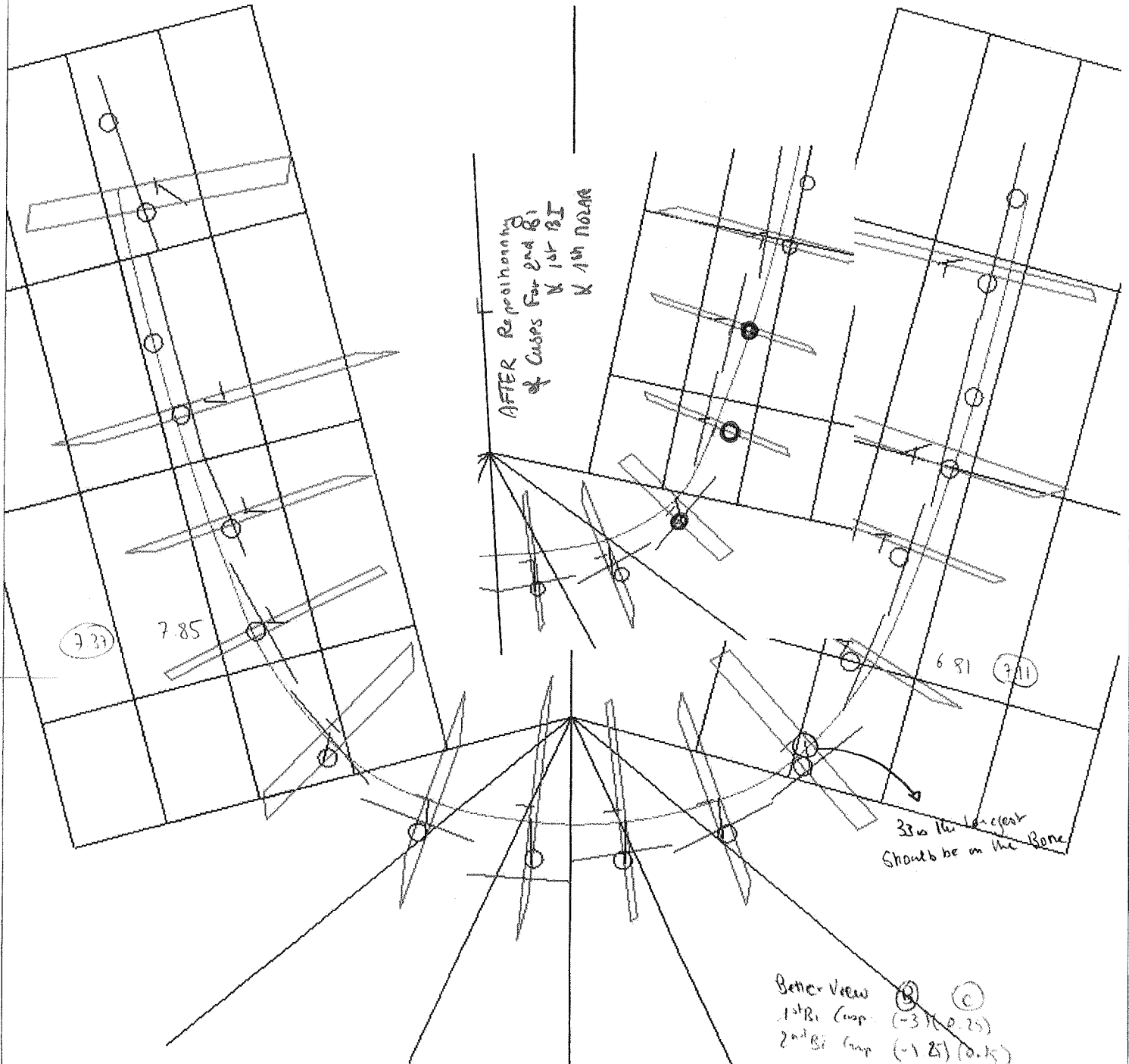
ORM053896

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**ORMCO CONFIDENTIAL AND PROPRIETARY INFORMATION**

- © Lower/upper setup for the PK Thomas case: November 97
- b. 3D Digitizing (Eric Chapoulaud)
- 1) Accomplishments / Status
    - ☒ No Action this month
    - ☒ A backlash problem was detected in the Z Axis of the scanner. A Newport technician was called upon to repair the axis.
  - 2) Goals For November
    - ☐ Reinstall the repaired Z axis. Realign the Z axis to the correct position.
    - ☐ Recalibrate the Scanner, using standard procedure.
    - ☐ Scan a standard mal-positionned case, to use as test data with the new set-up software being developed.
  - 3) Major Project Milestone
    - © First Clinical case scan: November 97.
- c. Bracket Fabrication (Eric Chapoulaud)
- 1) Accomplishments / Status
    - ☒ Hardware upgrade of the ModelMaker II was installed by Sanders.
    - ☒ Printed better quality parts.
    - ☒ Slicing Software upgrade for better reliability.
  - 2) Goals For November
    - ☐ Print and cast parts to improve the process.
  - 3) Major Project Milestone
    - © Reliable printing operation: January 98.

Standard Net Occlusion

Notar are Tipped to Flat  
Occlusion

- 1) Back Position: Not Symmetrical  
2b in 170 width
- 2) Cusps Position for the Bi's & Notars

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GLENORA CA 91740  
Tel: (909) 996 0100

Landmarks picked by Craig

Sect4.ovs

NOTABIGULAR

Scale  
2/12/98

XXXXXXXXXX

STANDARD NAOCCLUSION

2/13/98

Mesiodistal Width  
MANDIBULAR

2/12/98  
Craig Ribbed

16 width  
10 width

Physical Dim (Compensator)	True Dist	Top Longitudinal
1 — .225	5.72	5.65
2 — .243	6.17	6.04
3 — .272	6.91	6.05
4 — .280	7.11	5.61
5 — .275	6.99	6.32
6 — .440	11.18	10.07
7 — .419	10.64	9.77
	<u>2.154</u>	<u>54.17</u>
1 — .223	5.66	5.66
2 — .258	6.55	6.55
3 — .263	6.68	6.35
4 — .290	7.37	7.66
5 — .292	7.42	6.10
6 — .446	11.33	10.91
7 — .424	10.77	9.54
	<u>2.196</u>	<u>56.81</u>
	4.350	110.98

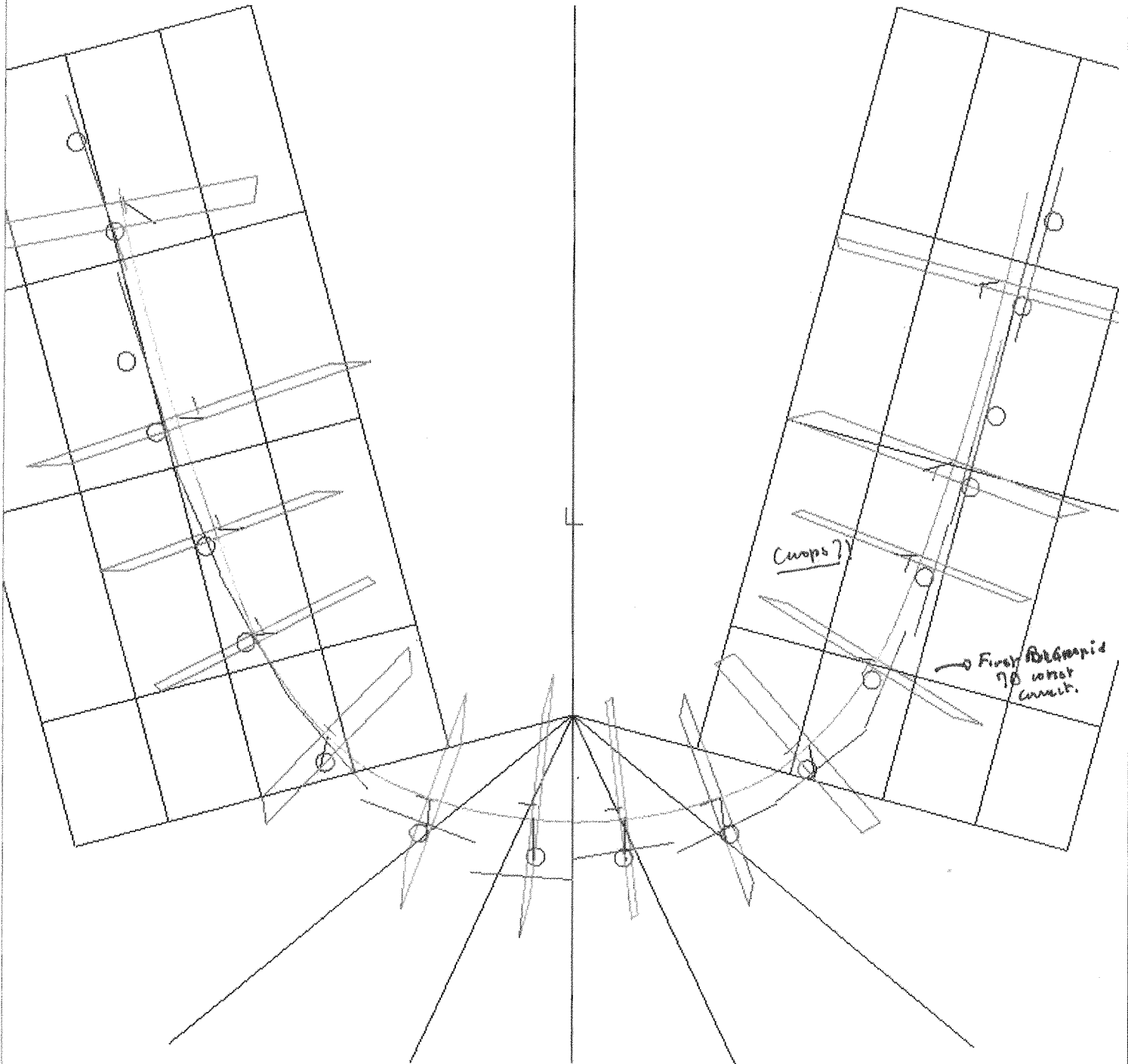
6.95 20  
6.35 20

11 213 11 48

10.9 9.85 10.9

STANDARD MAL OCCLUSION

Molar Tipped to Flat Ocul.



- Occlusal Height Corrected
- Curve Intersection Pts.

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MANDIBULAR  
CRAIG'S LANDMARKS

Sect4.ovs

Corrected

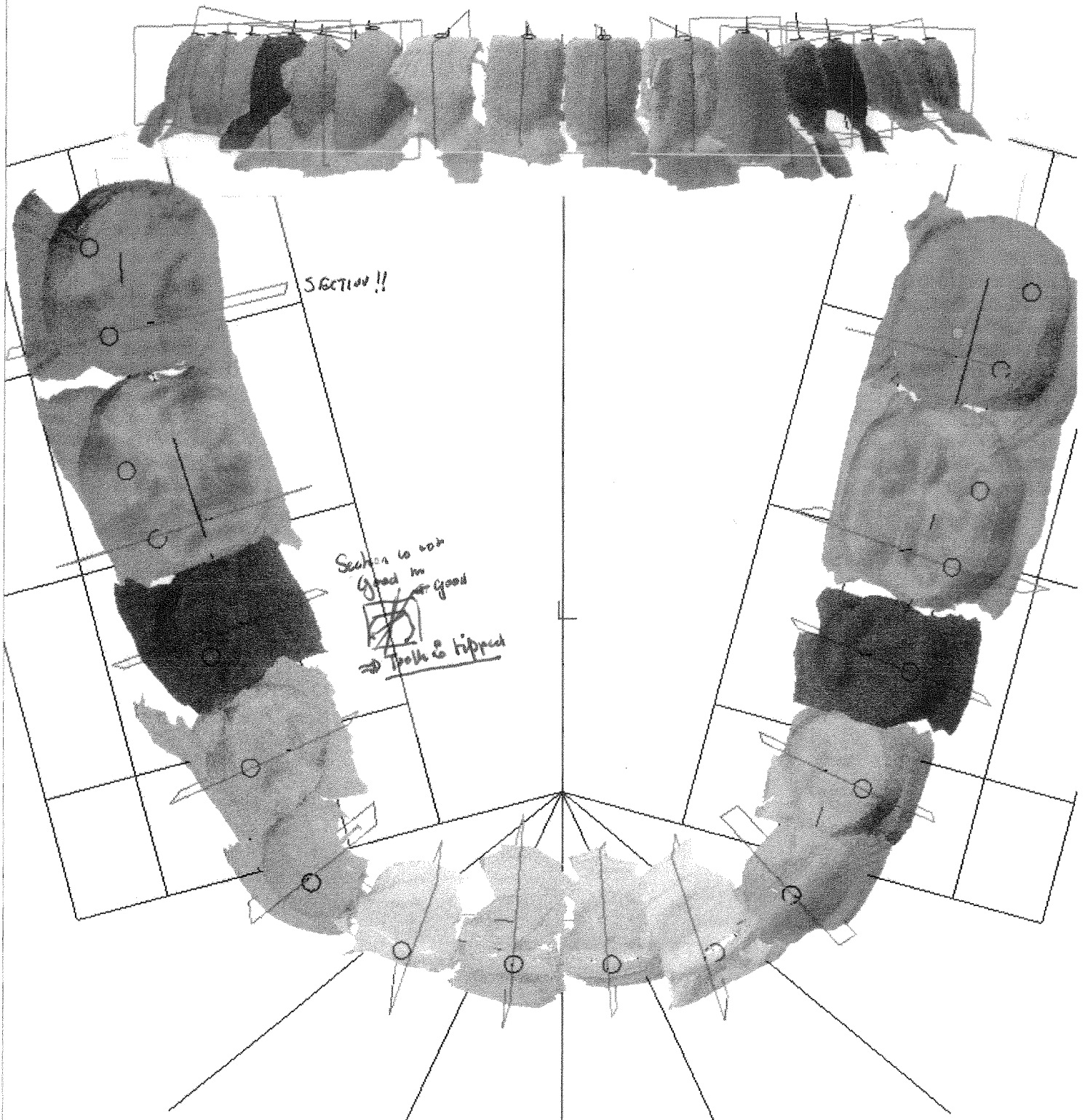
Scale

2/13/98

XXXXXXXX

# STANDARD MALOCCLUSION

EXHIBIT V



- Occlusal Height corrected
- Curve interocclusion corrected

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File

Test4.OVS

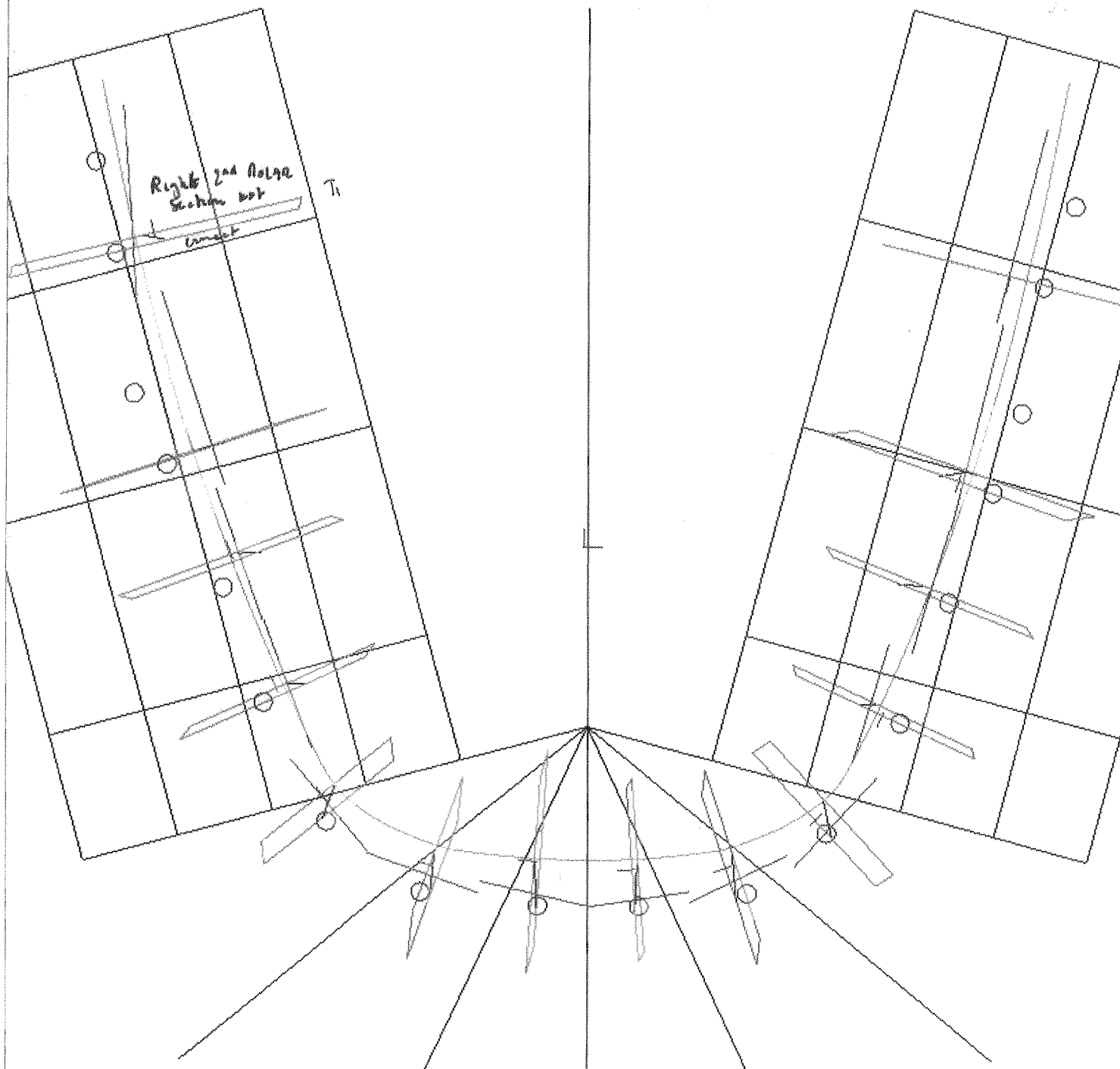
Scale

2/13/98

MANDIBULAR

ERIC'S PICK

XXXXXXXX



- Occulment Height corrected  
- Curve intersection corrected.

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MANUFACTURED  
ERIE'S PICK

File

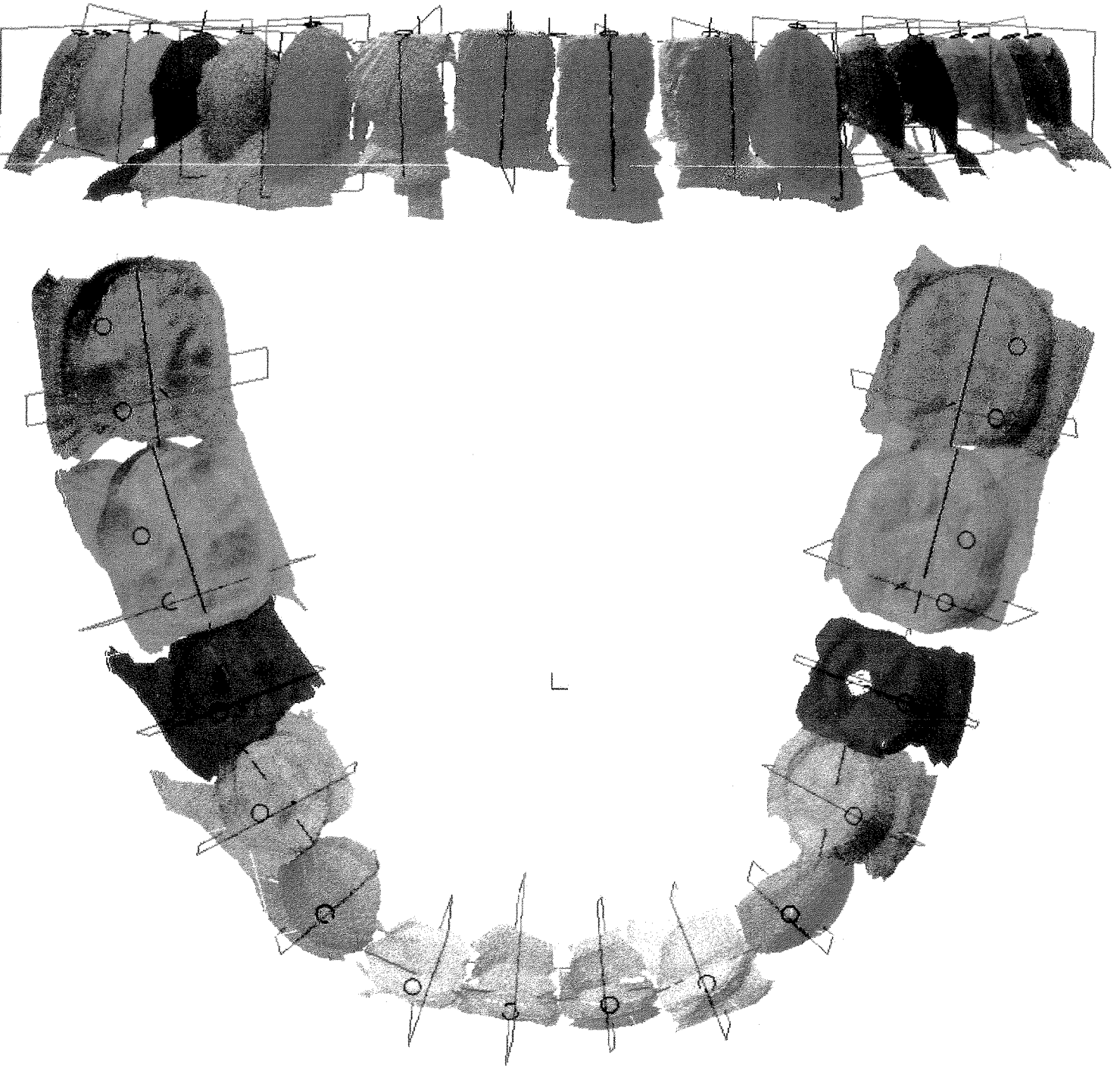
Test4.OVS

Scale

2/13/98

XXXXXXXXXX

# EXHIBIT V



All modifications decided on 2/13/98  
have been done - Result is a more symmetric  
Set-up.

Notes not printed.

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File

xUppers.OVS

Scale

~~2/12/98~~ 2/24/98

MANDIBULAR Set-up  
ERIC'S PICK

NO Symmetric

(NO α cusps defined on Oriented View)

XXXXXXXX